GOD'S DESIGN®

# Heaven & Earth

Our **Weather & Water**

Our **Universe**

Our **Planet Earth**

MASTERBOOKS CURRICULUM

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*God's Design® for Heaven & Earth* is a complete life science curriculum for grades 3–8. The books in this series are designed for use in the Christian school and homeschool, and provide easy-to-use lessons that will encourage children to see God's hand in everything around them.

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# Our Water & Weather

# Our Universe

# Our Planet Earth

# Welcome to GOD'S DESIGN®

## HEAVEN & EARTH

**You are about to start an exciting series** of lessons on Earth science. *God's Design® for Heaven and Earth* consists of: *Our Universe*, *Our Planet Earth*, and *Our Weather and Water*. It will give you insight into how God designed and created our world and the universe in which we live.

No matter what grade you are in, third through eighth grade, you can use this book.

## 3rd–5th grade

Read the lesson.

Do the activity in the light blue box (worksheets will be provided by your teacher).

Test your knowledge by answering the **What did we learn?** questions.

Assess your understanding by answering the **Taking it further** questions.

Be sure to read the special features and do the final project.

There are also unit quizzes and a final test to take.

## 6th–8th grade

Read the lesson.

Do the activity in the light blue box (worksheets will be provided by your teacher).

Test your knowledge by answering the **What did we learn?** questions.

Assess your understanding by answering the **Taking it further** questions.

Do the Challenge section in the light green box. This part of the lesson will challenge you to do more advanced activities and learn additional interesting information.

Be sure to read the special features and do the final project.

There are also unit quizzes and a final test to take.

When you truly understand how God has designed everything in our universe to work together, then you will enjoy the world around you even more. So let's get started!

# Our Weather & Water

# UNIT 1

# Atmosphere & Meteorology

1 A Christian View of Weather

2 Structure of the Atmosphere

3 The Weight of Air

4 The Study of Weather

- **Describe** three major events that have shaped the earth we see today.
- **Identify** and **describe** the layers of Earth's atmosphere.
- **Describe** the five atmospheric conditions studied by meteorologists.

# 1

# A Christian View of Weather

## What does the Bible say?

### What events in history have affected our weather?

**Is there a Christian view of weather? Isn't** weather just what happens outside? How can there be a Christian or non-Christian view of precipitation? Many people believe that you can separate your beliefs about God from your understanding of science. However, what you believe about God affects how you approach everything in life, so it even affects your understanding of weather. If you believe what the Bible says, then you know God sends the rain (see Jeremiah 5:24 and Jeremiah 14:22) and withholds the rain (see Amos 4:7). God controls storms (see Matthew 8:23–27). But most importantly, God created the earth and everything in it. He set up the way the weather operates, and He can work within the natural laws He has established as well as outside those laws to accomplish His purposes.

The planet that we live on has been affected by three major events in history. The first was the creation. In the beginning, everything was very good. But man rebelled against God and as a result God cursed the earth. Later, because of man's continual sin, God destroyed all of the people, except those in Noah's family, by sending a worldwide flood. This Flood had a tremendous effect on the planet, including changing the weather. We will look at the weather before and after the Flood in later lessons.

Our belief about God determines whether we recognize the weather patterns as random changes of nature or as a lovely system with an intelligent designer. Do we recognize the water cycle as a gift from God or just a random happening? If we view the planet Earth and its weather from a Christian perspective, we will know that it was supernaturally created, it is designed by God, it is relatively young (about 6,000 years), it was created in perfection, and it was created for mankind to show God's love and provision for us. If we recognize these things when we study weather, we will see God's hand and understand Him more clearly.

## What did we learn?

- Is there a Christian view of weather?
- What three events described in the Bible have greatly affected the weather on Earth?
- List three things you can learn about the weather from a newspaper weather report.

## Taking it further

- Why is it important to have a Christian view of weather?
- What are some geographical or physical characteristics that affect the weather in a particular area?

## Weather reports

Look at a weather report from your local newspaper or an Internet site. Most likely you will find information on the temperature and precipitation that your town received yesterday as well as a prediction for the weather conditions for today and several days in the future. What other information does your weather report give? Local weather can be affected by many factors, making it difficult to accurately predict. Do you live near the ocean or a large lake? That will affect the weather. Do you live near the mountains? That will affect your weather too. The amount of humidity and the wind will affect how you feel when you are outside.

Your weather report probably includes information on the weather across your state, as well as across the country. If your newspaper does not have this information, you can find it on the internet.

**Purpose:** To compare weather across the country

**Materials:** weather report from newspaper or Internet, "Weather Across the Country" worksheet

**Procedure:**

1. Enter your city or town on the first line of the chart and enter the weather conditions for your home town.
2. Enter the predicted weather conditions for each of the cities listed.

**Questions:**

- How does the weather in your town compare to the weather in other cities across the country?
- Why do you think the weather is so different from one city to another?

**Conclusion:** You will begin to understand the complexities of weather and how difficult it is to predict the weather as we go through the lessons in this book.

## Bible-believing scientists

Today, many people say that if you believe that God created everything you cannot be a good scientist. But is this true? Of course not! Many great scientists in the past believed the Bible. Sir Isaac Newton, considered by many to be one the greatest scientists of all time, believed in God and was a creationist. Sir Francis Bacon, credited with developing the scientific method, recognized God's hand in the world around him. This is why he believed that you could test your hypotheses to see if you were right, because God had created an orderly universe just waiting for us to discover the wonders that He had placed there.

Today, many scientists believe the Bible and are contributing to scientific research. If you are interested in meteorology and weather, you can be a good scientist, too. If you believe the Bible and recognize that God designed our weather system, you can contribute to a better understanding of our world by being a Bible-believing scientist.

Choose a Christian scientist from the past and research his contributions to science. Write a short report on what you learned and share it with your class or family. You can be encouraged by knowing that many of the greatest scientists have believed that God created this world and not that it evolved by chance. Below is a list of scientists you can choose from.

- Sir Isaac Newton (physics)
- Lord Kelvin (thermodynamics)
- Blaise Pascal (hydrostatics)
- Johannes Kepler (astronomy)
- Carl Linneaus (biology)
- Robert Boyle (chemistry)
- Charles Babbage (computers)
- Joseph Lister (surgery)
- David Brewster (mineralogy)
- Louis Pasteur (bacteriology)
- James Clerk Maxwell (electronics)
- Dr. Raymond Damadian (inventor of the MRI)

# 2

# Structure of the Atmosphere

## Layers above the earth



### What is Earth's atmosphere like?

### Words to know:

- atmosphere
- troposphere
- stratosphere
- mesosphere
- thermosphere
- ionosphere
- exosphere
- magnetosphere
- aurora borealis
- aurora australis

### Challenge words:

lapse rate

**When we think of the earth, we usually** think of the solid ground on which we stand. This ball of rock we call Earth is a very special place. Unlike the other planets in our solar system, Earth has an atmosphere specially suited for life. The **atmosphere** is the layers of gas that surround the planet. These gases are kept close to the surface of the earth by the earth's gravity. The earth's atmosphere consists of 78% nitrogen, 21% oxygen, and 1% other gases, including hydrogen, helium, argon, and carbon dioxide. This combination of nitrogen and oxygen is the ideal atmosphere for life. Nitrogen is a relatively nonreactive gas. Its purpose in the atmosphere appears to be to dilute the oxygen. Nitrogen also helps protect the earth from gamma rays from the sun. If the oxygen concentration was more than 21%, fires would easily burn out of control. Yet animals and humans need oxygen to breathe, and 21% appears to be the ideal concentration.

The earth's atmosphere not only provides needed oxygen, it also protects life from several harmful effects of space. First, the atmosphere insulates the earth from the extreme temperatures of space. The atmosphere keeps the surface temperature of the earth relatively the same. Temperatures on Earth range from –60 to 140 degrees Fahrenheit (–51 to 60 degrees Celsius) at the extremes and are more likely to be between 0°F and 100°F (–17°C to 38°C). However, on the moon, which has no atmosphere, the temperature can be as much as 260°F (127°C) in the sun and –280°F (–173°C) on the side facing away from the sun. The earth's atmosphere protects us from these extremes.

The atmosphere also protects us from the vacuum of space. The air pressure provided by the atmosphere is necessary for our bodies to function correctly. Also, the atmosphere protects us from harmful radiation. The ozone in the atmosphere filters out much of the ultraviolet rays from the sun. These rays can damage our skin and cause skin cancer. Finally, the atmosphere protects the surface of the earth from many impacts. Just compare the surface of the earth with the surface of the moon. The moon's surface is covered with craters caused by impacts. Yet relatively few impacting bodies reach the surface of the earth because most burn up in the atmosphere; when we see this happen, we call them meteors, or shooting stars.

The atmosphere consists of several layers of gases. The layer closest to the surface of the earth is called the **troposphere**. The troposphere is the layer beginning at the surface of the earth. Its thickness varies from 4 to up to about 7 miles (12 km) above the surface. Eighty percent of all air molecules are in the troposphere. All of the weather occurs in the troposphere and there is significant mixing of the air in this layer. In general, the temperature decreases with increasing altitude in the troposphere.

The next layer of the atmosphere is called the **stratosphere**. This layer extends from about 6 to 30 miles (10–50 km) above the earth's surface. The stratosphere contains the ozone layer as well as the jet stream—an area in the atmosphere with very fast moving air. Most passenger planes fly in the lower stratosphere because of the lack of weather and the jet stream. The temperature in the stratosphere tends to increase with altitude.

Above the stratosphere is the **mesosphere**. The mesosphere is 30 to 50 miles (50–85 km) above the earth. There are variable winds in this layer and the temperature decreases with altitude. The coldest part of the atmosphere is at the top of the mesosphere where the temperatures can be as low as −164°F (−109°C).

The **thermosphere** is the layer that is 50 to 370 miles (85–600 km) above the earth. The molecules in this layer are very far apart and are easily warmed to very high temperatures by the sun. This layer contains the ionosphere. In the **ionosphere**, gas molecules are broken apart into atoms by the radiation of the sun. Some of these atoms lose electrons and become electrically charged ions. These ions reflect short-wave radio waves but allow microwaves to pass through. For



## Properties of air

**Purpose:** To demonstrate that air contains oxygen and that air pressure changes with temperature

**Materials:** candle, modeling clay, jar, dish,match or lighter

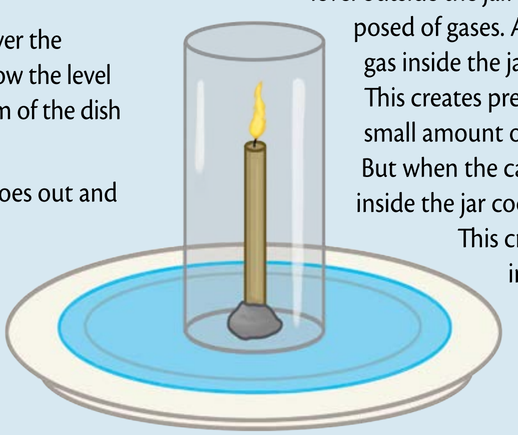
**Procedure:**

1. Attach a candle to the bottom of a dish with a piece of modeling clay.
2. Fill the dish half full with water.
3. Light the candle and quickly place a jar over the candle so that the mouth of the jar is below the level of the water without touching the bottom of the dish and note the water level inside the jar.
4. Watch the candle burn until the flame goes out and now note the water level inside the jar.

**Conclusion:**

You should have observed two things happening inside the jar. First, the candle only burns for a short period of time. Oxygen is necessary for the candle to burn. The atmosphere consists of about 21% oxygen and 78% nitrogen. Initially there is oxygen in the air inside the jar, but no additional air can enter the jar since the mouth of the jar is underwater. As the candle burns the oxygen is soon used up and the flame goes out.

Second, you should have seen that after the candle goes out the water level inside the jar is higher than the water level outside the jar. The atmosphere is composed of gases. As the flame burns the gas inside the jar heats up and expands. This creates pressure which forces a small amount of water out of the jar. But when the candle goes out the gas inside the jar cools down and contracts. This creates lower air pressure inside the jar than outside the jar so the air outside the jar pushes more water into the jar.



this reason, microwaves are used for communication with astronauts and satellites in space.

The outermost layer of the atmosphere is the **exosphere**, which extends to 60,000 miles (96,000 km) above the earth. Within this layer lies the **magnetosphere**. It consists of protons and electrons from space that have become trapped by the earth's magnetic field. These particles move from pole to pole. Near the poles, some particles move into the lower atmosphere. When they collide with other particles in the atmosphere they give off a beautiful light often called the northern lights, or **aurora borealis**, near the North Pole, and the southern lights, or **aurora australis**, near the South Pole. When the sun experiences solar flares, a higher concentration of particles becomes trapped in the magnetosphere and the northern lights and southern lights are more visible.

## What did we learn?

- What are the two main components of air?
- What are the five levels of the atmosphere?
- What are some ways that the atmosphere protects us?

## Taking it further

- How would the earth be different if there were a higher concentration of oxygen?
- What would happen if the nitrogen in the atmosphere was replaced with a more reactive element, such as carbon?



## Atmospheric temperature

The temperature in the atmosphere changes as you go up in altitude. If you have ever climbed a mountain, you know that it is often colder at the top of the mountain than at the bottom. The temperature generally goes down as you go up in the troposphere. The temperature drops about 3.5°F per 1,000 feet (6.4°C for each kilometer) that you go up. This rate of decline is called the **lapse rate**. At about 11 kilometers above the earth, the temperature stops declining. It begins to increase at about 12 kilometers.

The temperature tends to increase as you go up through the stratosphere. Temperature again decreases as you go up through the mesosphere and then increases again as you go up through the thermosphere.

Using a chart showing the temperature ranges and altitudes for each layer of the atmosphere, complete the following activity.

**Purpose:** To create a graph showing how the temperature changes with altitude

**Materials:** paper, pencil or pen, atmosphere temperature chart

**Procedure:**

1. Begin your graph by labeling the x-axis with temperatures ranging from -100°C to 100°C. Label the y-axis with altitudes from 0 to 110 kilometers.
2. Plot the points from the chart to the right on your graph, and draw lines to show how the temperature increases or decreases as you go up in altitude.
3. Finally, shade and label each layer of atmosphere in your graph. Shade from the bottom to 12 km blue and label it troposphere. Shade from 12–50 km green and label it stratosphere. Shade from 50–80 km yellow and label it mesosphere. And shade from 80 to the top of graph red and label it thermosphere.

| Altitude (km) | Temperature (°C) |
|---|---|
| 0 | 25 |
| 12 | –50 |
| 50 | 0 |
| 80 | –80 |
| 100 | 50 |

3

# The Weight of Air

It has weight?



## How much does the air weigh?

**How much does air weigh? You might** think that this is a strange question, because you think that air doesn't weigh anything. You might think that you can't see or feel air, so it must not weigh anything. However, you would be wrong. Although air is very light, it still has mass and weight. As you learned in the previous lesson, the air is made up of mostly nitrogen and oxygen atoms. Each of these atoms weighs a tiny amount, but when you add up the weight of all the molecules in a cubic foot of air it weighs about 1/10 of a pound, and when you add up the weight of all of the air molecules in the atmosphere, the air surrounding the whole planet weighs about five million billion tons. Now that's a lot of air!

The air has weight because gravity is pulling down on the air molecules. This means that air molecules are pressing against us all the time. In fact, the air presses on our bodies with about 14.7 pounds of pressure per square inch when we are at sea level. So why don't we feel the pressure of the air on our bodies? God designed our bodies to push out with about the same amount of pressure that the air is pushing in, so we don't feel the weight of the air around us. The air pressure is not constant in every part of the world, however. At low elevations, the air pressure is greater, since the molecules of air are compressed from the weight of the air above them. However, at higher elevations, there's less pressure and the molecules are more dispersed, or thinner.

So, what does the weight of air have to do with weather? The weight of air contributes to the air pressure in the atmosphere. Changes in air pressure cause the wind to blow and move weather fronts around the globe. If the air had no weight, the wind would have no force and we would have no changes in the weather. We will be learning more about air pressure in future lessons.

### Fun Fact

The Bible speaks about the weight of the air in Job 28:24–27, "For He looks to the ends of the earth, and sees under the whole heavens, to establish a weight for the wind, and apportion the waters by measure. When He made a law for the rain, and a path for the thunderbolt, then He saw wisdom and declared it; He prepared it, indeed, He searched it out." We see that the Bible is true even in small details such as the fact that air has weight.

# What did we learn

- What causes air to have weight?
- How much air pressure do we experience at sea level?
- Why don't we feel the weight of the air molecules?
- Do you expect air pressure to be the same at all locations in the world?

# Taking it further

- Why is it important that air has weight?
- Why must aircraft be pressurized when flying at high altitudes?

## Demonstrating the weight of air

**Purpose:** To show that air has weight

**Materials:** two identical balloons, string, a yard or meter stick, tape

**Procedure:**

1. Tape an empty balloon one inch (3 cm) from each end of the yardstick.
2. Tie a 2-foot long piece of string to the center of the yard stick.
3. Hold the end of the string on the edge of a table so that the yard stick is hanging down from the table and adjust the string until you are able to get the stick to balance.
4. Have someone hold the string and stick in place while you remove one of the balloons.
5. Fill the balloon with air and tie it shut. Tape it back to the yardstick in the same location that it was in before.
6. Release the stick and watch to see if it is still balanced.

**Conclusion:** The weight of the air in the balloon should make the stick tip downward on the side with the filled balloon. This shows that even though we cannot see the air, it really does have weight.

# Air pressure

All molecules have weight. You just demonstrated that the nitrogen and oxygen molecules in air have a small weight. Different molecules have different weights. Hydrogen and helium are the two smallest and lightest elements. When a balloon is filled with hydrogen or helium gas it will float because it becomes lighter than the air around it. Gravity does not pull down on the helium-filled balloon as much as it does on the air so the balloon floats. Scientists who study the weather take advantage of this property to fly weather balloons. Weather balloons are filled with either helium or hydrogen and are attached to weather instruments. Then they are allowed to float through the atmosphere and take readings.

Hot air balloons use a similar principle, but instead of using a lighter gas, the air in the balloon is heated. Hot air is lighter than cool air because the molecules are farther apart. This allows the balloon to float.

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**Purpose:** To demonstrate that the weight of air has force

**Materials:** grocery-size plastic bag, widemouth jar, string or rubber band

**Procedure:**

1. Push a grocery-sized plastic bag into a wide-mouth jar, leaving the edges of the bag hanging over the edge of the jar.
2. Tie a string very tightly below the threads of the jar. You could use a very tight rubber band instead of the string. Think about what is in the jar. If you said a plastic bag you are only partially right. There is also air inside the jar.
3. Carefully pull the bag out of the jar.

**Questions:**

- What do you observe happening inside the jar?
- Why won't the bag come out?

**Conclusion:** The bag will not come completely out of the jar unless you force it out. There is air inside the jar. This air is pressing down on the bag. Because the edges of the jar are sealed by the string, no new air can get into the jar to push up on the bag, so the weight of the air holds the bag inside the jar.

# Discovery of Air

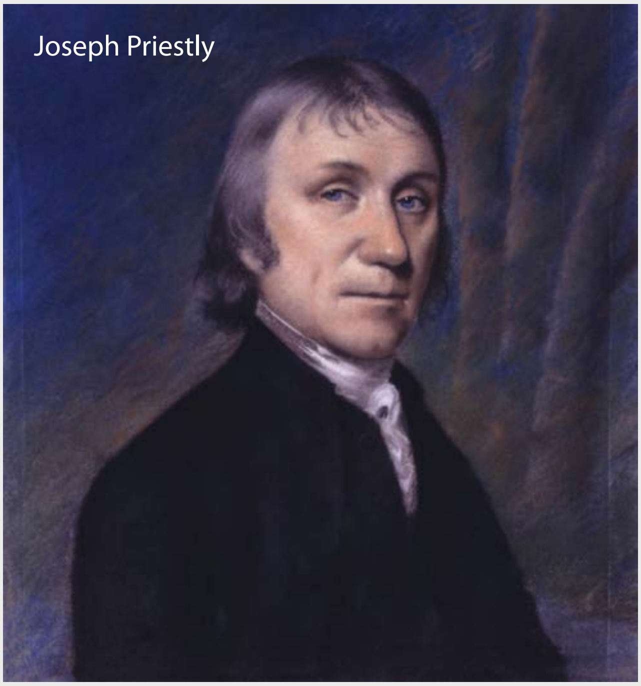
SPECIAL FEATURE

**Air—it's all around us and very important** to us. It's mainly important because of what's in it. Three men who all lived during the time of America's Revolutionary War worked to find out what is in the air. Joseph Priestly, Karl Scheele, and Daniel Rutherford each independently discovered what the air is made of.

Joseph Priestly, who studied to be a minister, was not even interested in science. However, while he was in London in 1766, he met a well-known American named Benjamin Franklin. He and Franklin became lifelong friends and through Franklin's influence, Priestly became interested in science. Joseph Priestly's first interest in science was in electricity. Later Benjamin Franklin wrote a letter to Joseph telling him about a gas, or bubbles, that would rise from the bottom of a river and would burn if a flame was held close to the surface of the water.

This letter changed the direction of Joseph's work, and he became interested in the gas that would burn. In his work, he discovered that air was not a single element but was made up of different gases. The first gas that Priestly discovered was carbon dioxide. He also discovered eight other gases in his work. But the most important gas that he discovered was oxygen, which is necessary for combustion, or burning, .

Karl Scheele was a scientist who also had an interesting start. At the age of 14 he began working as an apprentice to a pharmacist in Gothenburg, Sweden. He worked for the pharmacist for eight years. There he spent his nights devoted to the study of the standard works of chemistry and to experimental examination. His attention to detail, and a lot of practice, allowed him to make many new discoveries. Around 1773 he discovered that air was made up of two parts—one part would support combustion and the other would prevent it. The gas that supported combustion was oxygen.




The third scientist credited with discovering the components of air is Daniel Rutherford. Rutherford went to the university in Edinburgh, Scotland. There he held the first chair of the Theory and Practice of Medicine. After spending three years learning about continental medical practices in Europe, he set up his own medical practice in Edinburgh. He became a Fellow of the Royal College of Physicians and later went on to become its secretary and president. He conducted many experiments. While working with mice, he found that many of them died. When examining the causes of their death he discovered what he called noxious air. Today we call it nitrogen.

At one time people believed that air was one element, but the work of these three men gave insight into the composition of air and began scientists on the road to understanding our atmosphere and how it works.

# 4

# The Study of Weather

## An introduction to meteorology



### What do meteorologists study?

### Words to know:

| | |
|---|---|
| meteorology | absolute humidity |
| temperature | relative humidity |
| air pressure | wind |
| atmospheric pressure | precipitation |
| humidity | |

**Meteorology is the study of the** atmosphere. Most of the studies concentrate on the troposphere and the weather that occurs there. Conditions in the troposphere are most affected by the energy and heat from the sun and their effects on the gas molecules and water molecules in it. Energy from the sun reaches the earth in the forms of visible light, ultraviolet light, and infrared light. Most of the ultraviolet light, which is harmful, is absorbed by the ionosphere. The visible light allows us to see. But the infrared radiation has the most effect on our weather. The infrared light passes through the atmosphere and warms the surface of the earth, which warms the air, causing air currents and leading to most of the weather that we experience.

Meteorologists study five major conditions of the atmosphere. The first condition is temperature. **Temperature** is a measure of the intensity of heat in the air. It measures the movement of the air molecules. The molecules in warm air are moving faster than the molecules in cool air.

The second condition studied by meteorologists is **air pressure**, also called **atmospheric pressure**. The molecules in the air are pulled toward the earth by gravity. The weight of these molecules pushes on everything on the earth. Warmer air expands and is less dense so it has less pressure. Cooler air contracts, so the air molecules are closer together

The air pressure is lower at higher altitudes.

## Fun Fact

The energy absorbed from the sun is one of the major factors that drives the weather. Different parts of the earth absorb different amounts of sunlight. Forests are generally dark and absorb over 90% of the rays that reach them. Oceans and lakes absorb between 60% and 96% of the rays that reach them. On the other hand, snow reflects sunlight and absorbs less than 25% of the rays that reach it. This helps explain why tropical rain forests are generally warm and the North and South Poles are colder.



and thus exert more air pressure. Air pressure is also affected by altitude. There are fewer air molecules at higher altitudes than at lower altitudes so there is lower air pressure at higher altitudes. This is why you may become tired more easily when hiking in the high mountains than at sea level. It is also why airplanes pressurize their cabins to maintain a comfortable air pressure during flights.

Meteorologists study areas of high and low air pressure to help determine the weather patterns. Areas with low pressure usually have warm, moist air. This usually results in warm cloudy weather. Areas with high pressure usually have cooler and drier air. This usually results in clear cool weather.

The third condition that meteorologists study is **humidity**. Humidity is a measure of the amount of water vapor in the air. There are two kinds of humidity measurements. **Absolute humidity** measures the actual amount of water in the air. **Relative humidity** measures the ratio of the amount of water in the air compared to the amount of water that the air could hold at that temperature. Warmer air can hold more water than colder air. So, different samples of air could have the same absolute humidity but different relative humidity if they were at different temperatures.

The fourth atmospheric condition which interests meteorologists is **wind**. Meteorologists measure the direction that wind comes from and the speed at which it travels. This helps them determine weather patterns as well.

## Making air currents

Energy from the sun is the primary source of weather on Earth. As the sun heats up the earth and the air, the air molecules move around creating air currents. The same thing happens when water is heated and cooled. You can observe water currents to better understand air currents.

**Purpose:** To demonstrate how the sun heats our planet and causes air currents

**Materials:** baking dish (white or light color works best), several Styrofoam cups, food coloring, ice, boiling water

**Procedure:**

1. Place 3 or 4 Styrofoam cups (depending on the shape of your baking dish) upside down, and set a baking dish on top of them.
2. Fill the dish half full of room temperature water and allow it to sit until the water is completely still.
3. Place a cup of ice under the dish near one end and a cup of boiling water under the dish at the opposite end.
4. After two minutes, place a drop of food coloring in the water in the baking dish near each end of the dish. Observe how the food coloring moves through the water. Draw several pictures during the next 10 minutes showing how the color moved..

**Conclusion:** The water in the baking dish was heated by the cup of boiling water so the water molecules in that area began to move more quickly. The water molecules above the ice began to move more slowly. This caused currents in the water. You were able to see these currents as they carried the food coloring around the dish. This same process occurs in the atmosphere. The sun heats areas of the earth and the air molecules in that area move more quickly causing air currents. This uneven heating helps weather systems to move from one part of the earth to another.

Finally, meteorologists study **precipitation**. Precipitation is water that escapes from the atmosphere. Precipitation takes on many forms depending on the atmospheric conditions. These forms can include rain, snow, hail, and sleet. All of these conditions work together to provide the weather on our planet.

## What did we learn?

- What is meteorology?
- What are the five important conditions in the troposphere that meteorologists study?

## Taking it further

- Why are meteorologists interested in studying the conditions of the troposphere?
- How does the sun heat areas of the earth that do not receive much direct sunlight?

## Weather ingredients

There are basically four main ingredients required to make weather. The first is the earth. Without the planet itself, there would be no sense in talking about the weather. The earth absorbs the energy from the sun and heats up. The sunlight hits different parts of the earth at different times because of the rotation of the earth on its axis and because of the revolution of the earth around the sun. This movement contributes to the various weather patterns that occur around the world.

The second ingredient in weather is the sun. We have already discussed how the sun's rays warm up the earth which in turn warms the air. The sun is the energy source that fuels the weather.

The third ingredient is the air. Without the air molecules to move around, there would be no weather. Planets that do not have an atmosphere do not have weather. The air molecules are heated unevenly and thus move around. You will learn more about how this works in later lessons.

The final ingredient in weather is water. The air contains water all the time. Sometimes that water is in the form of water vapor which is a gas. Sometimes the water is a liquid, such as when it forms clouds or rain, and sometimes it becomes a solid, like snow or hail. The evaporation and condensation of water contribute greatly to the weather that we experience. You will learn more about water's role in weather, too. These four ingredients work together to create weather everyday.

Now for fun, do the "Weather Ingredients" worksheet to see how much you already know about the things that make up our weather.

Atmosphere & Meteorology