SCIENCE • GRADE 5

Science Content Standards
Earth Sciences: 4.A
Earth Sciences: 4.B
Earth Sciences: 4.E

On Level

The Air Around Us

LOOK INSIDE FOR:

- California's Academic Content Standards Covered
- Reproducible Student Book
- Reproducible English-language Arts Activities

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The Air Around Us
California's Content Standards Met

GRADE 5 SCIENCE

EARTH SCIENCES: 4—Energy from the Sun heats Earth unevenly, causing air movements that result in changing weather patterns. As a basis for understanding this concept:

a. Students know uneven heating of Earth causes air movements (convection currents).

b. Students know the influence that the ocean has on the weather and the role that the water cycle plays in weather patterns.

e. Students know that the Earth's atmosphere exerts a pressure that decreases with the distance above Earth's surface and that at any point it exerts this pressure equally in all directions.

GRADE 5 ENGLISH LANGUAGE ARTS

2.0 READING COMPREHENSION

Structural Features of Informational Materials 2.1—Understand how text features (e.g., format, graphics, sequence, diagrams, illustrations, charts, maps) make information accessible and usable.

Structural Features of Informational Materials 2.2—Analyze text that is organized in sequential or chronological order.

Comprehension and Analysis of Grade-Level-Appropriate Text 2.3—Discern main ideas and concepts presented in texts, identifying and assessing evidence that supports those ideas.

Expository Critique 2.5—Distinguish facts, supported inferences, and opinions in text.

SCIENCE • GRADE 5

Science Content Standards
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Student Book

The Air Around Us

Print pages 5–18 of this PDF for the student book.

How to Make the Student Book

- **The student book is contained on pages 5–18 of this PDF. It begins on the next page.**
- **To make one student book, or a two-sided master copy that can be photocopied, you will print on both sides of seven sheets of 8.5″ x 11″ paper.**
- **Do a test printout of one book first to familiarize yourself with the procedure.**
- **Follow these instructions carefully.**

First–Select the Paper

Since you will be printing on both sides of the sheets of paper, select a good quality white paper. We recommend using at least a 22lb sheet.

Second–Check Printer Settings

Be sure you have the correct page setup settings for your computer and printer. You will print these pages in landscape format.

Third–Print EVEN Pages

Open the PDF of the book you want to print. Select print from your file menu. In your printer's dialogue box enter pages 5–18 to print. Then select EVEN pages only. It is important to print only the EVEN pages first. Click "Print" to print the even pages. (**Important note**: The first page that prints will be blank. DO NOT discard this page. It will be needed to print the cover in the next step.)

Forth–Print ODD Pages

When the even pages have printed, flip the stack of pages over to print the odd pages. Place the stack back in your printer. Select print from the file menu again. In your printer's dialogue box, select ODD pages. Click "Print" to print the odd the pages.

Fifth–Fold the Book

You now have a complete book. Check to be sure the pages are in the correct order with the book's cover as the top page. Then fold the stack of paper in half.

Sixth–Staple the Book

Use an extended-length stapler to staple the pages together. Place three staples in the spine of the book.

Please note that printers vary in how they output pages. Do a test printing with one book and adjust the procedure as necessary.

If you want to make a one-sided master copy, print ALL pages 5–18 at once. Then select "one-sided to two-sided" on the copy machine.

OL

The Air Around Us

California's Content Standards Met

GRADE 5 SCIENCE

EARTH SCIENCES: 4—Energy from the Sun heats Earth unevenly, causing air movements that result in changing weather patterns. As a basis for understanding this concept:

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FOCUS ON CALIFORNIA STANDARDS

SCIENCE • GRADE 5

California Content Standards
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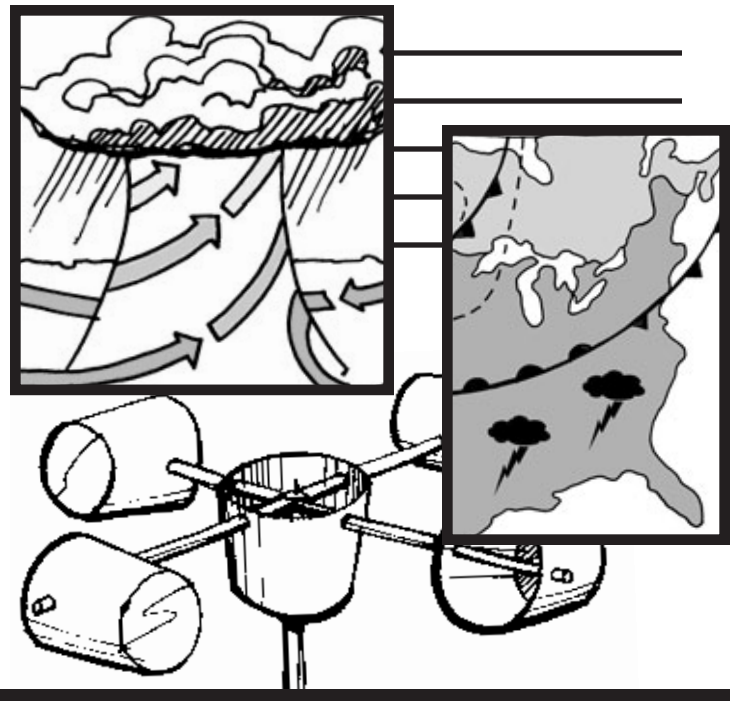
The Air Around Us

by

Caitlin Scott



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FOCUScurriculum

Curriculum materials for **your** content standards

Table of Contents

What do you think you will learn from this book?

INTRODUCTION

What Is Air?

It is surrounding you as you read this book, even though your eyes can't see it, and your hands can't feel it. In fact, it's totally **invisible**, but without it, you would die in a matter of minutes. What is this **mysterious**, unseen substance? If you guessed that the answer is air, you were correct.

How can we be absolutely certain that air exists when it is impossible to see it? Even though we can't see or feel air we know it exists, because it occupies space.

Remember the last time you blew up a balloon. Before you blew it up, it was flat and wrinkly. As you blew into the balloon, it inflated, becoming larger and smooth. What was inside the balloon that made the balloon inflate and hold its shape? The balloon was full of air.

invisible: not able to be seen
mysterious: not known or hard to explain

Try This

Here is an experiment you can do to prove that air exists and takes up space.

What You Need

- plastic bag
- large glass jar
- rubber band

What You Do First

1. Check the plastic bag to make sure there are no holes in it.
2. Fill the bag with air by blowing into it.
3. Attach the bag filled with air to the top of the jar with the rubber band. Be sure the rubber band is tight around the bag and jar so no air escapes from the bag.

4. Predict what will happen if you push the bag into the jar.

5. Try to push the bag into the jar. Be careful not to pop the bag.

6. Record your observations.

What You Do Next

1. Remove the rubber band and plastic bag from the jar.

2. Place the bag inside the jar and attach the bag to the jar with the rubber band. Again, be sure the bag is tight around the jar and that no air can escape.

3. Predict what will happen if you try to pull the bag out of the jar.

4. Try to pull the bag out of the jar. Record your observations.

Think About It

1. What was the effect of air when you pushed or pulled on the bag?

2. Does air take up space?

We Need Air to Survive

Air is made up of **gases**. The air we breathe is mostly made of nitrogen and oxygen. There are very small amounts of other gases, too—such as argon and carbon dioxide. You cannot see these gases, but they are there. We need them to **survive**.

When we inhale, our bodies use the oxygen in the air to get energy from food we eat. When we exhale, we breathe out unused nitrogen, some oxygen, and carbon dioxide. The carbon dioxide is a waste product from the process of getting energy from food. This is called **respiration**. Green plants need this carbon dioxide to grow and make food. Earth needs just the right balance of gases in the air, so that all plants and animals can survive. Think about all those different invisible gases the next time you take a deep breath!

gases: matter that has no shape; gases spread out to fill the space around them; most cannot be seen
survive: to continue to live
respiration: how living things get energy from food and oxygen

CHAPTER 1

Air and Weather

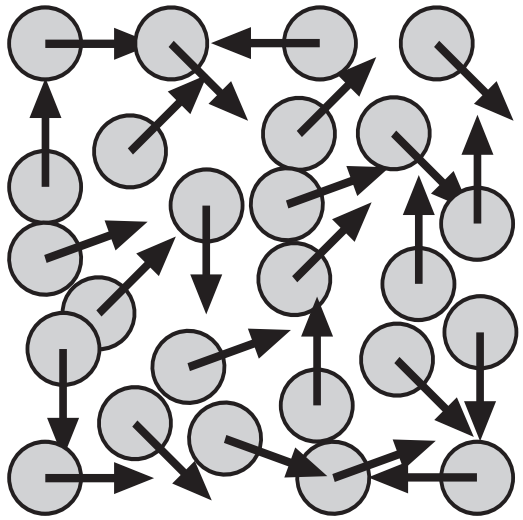
A gentle breeze cools you down on a hot day. A strong wind is wonderful for kite flying. But why do you think the wind blows? One reason is air pressure.

When your friend squeezes your arm, you feel the pressure of that squeeze. Air pressure does exactly the same thing by putting pressure on you. You just don't feel air pressure the same way you feel a tight squeeze from your friend.

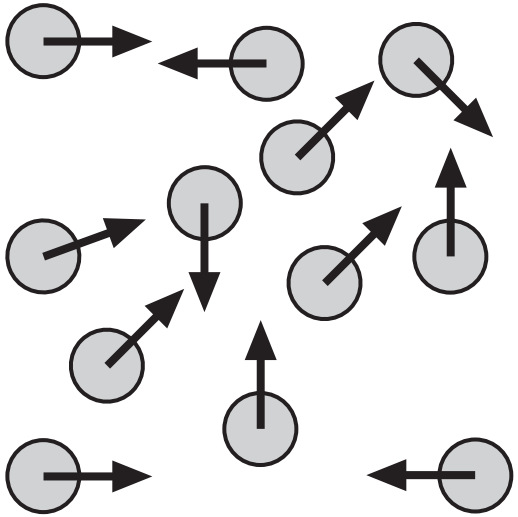
When air **molecules** are packed close together, they are at higher pressure, but when they are spread out, they are at lower pressure. For example, the molecules inside a full balloon are packed tightly together. The molecules inside the balloon are at a higher pressure than those outside the balloon.

molecule: the smallest part of a substance

Air Molecules Under High Pressure



Air Molecules Under Low Pressure

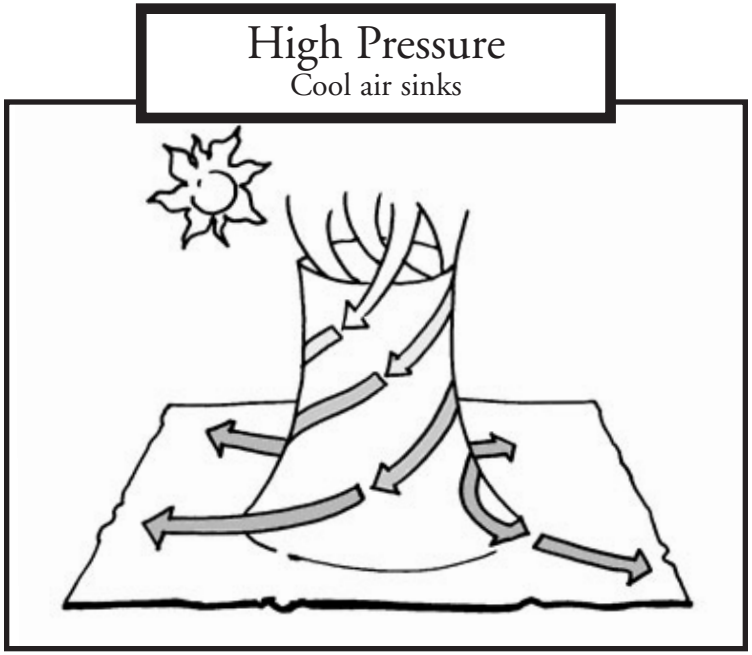


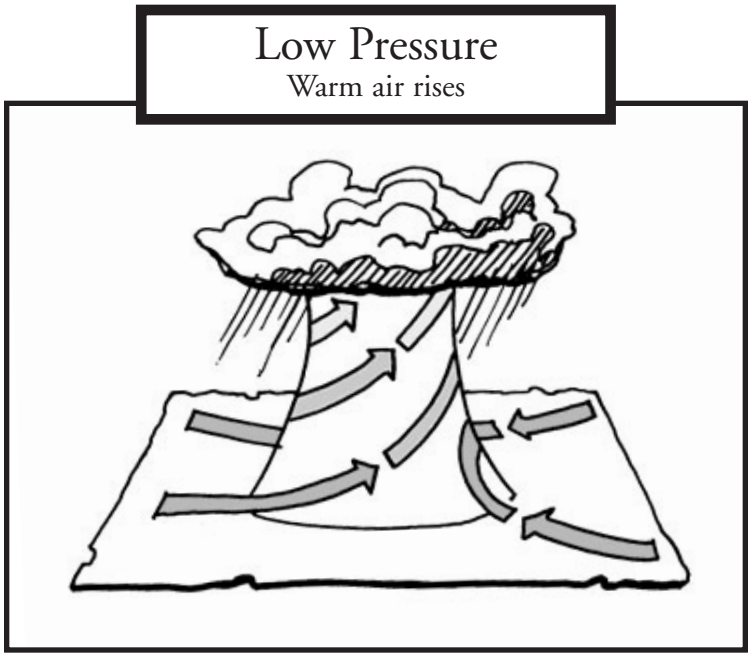
Air Pressure Changes

Why do people want to know about air pressure? Scientists have found that air pressure often changes when the weather changes. A drop in air pressure often means bad weather, but rising air pressure often means good weather.

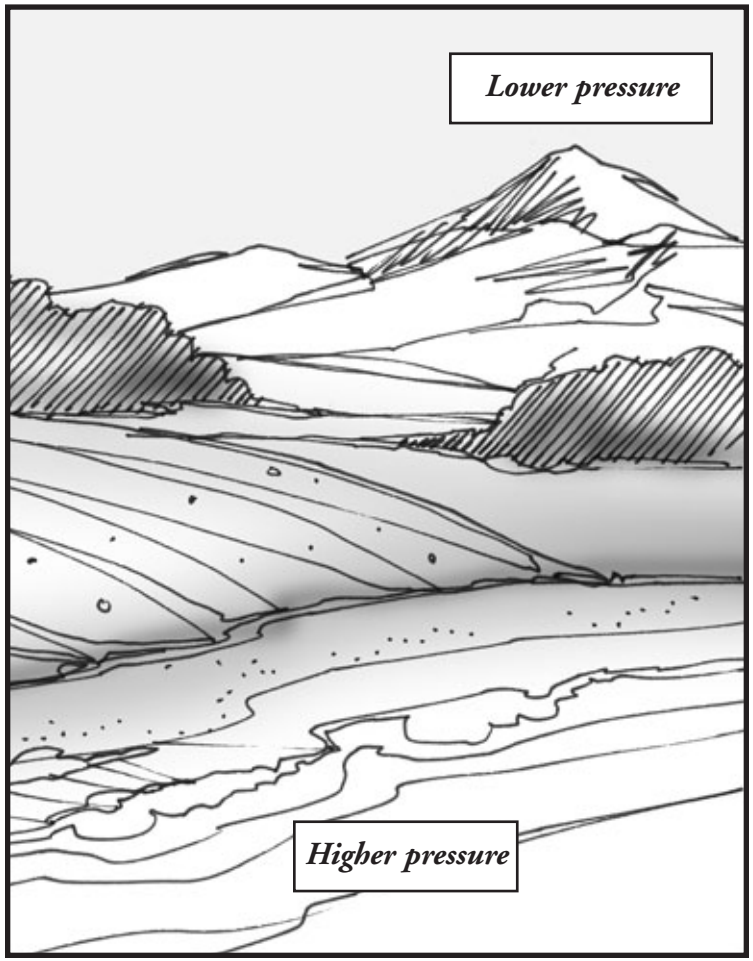
The column of air is higher and heavier in a high pressure area. This causes the air to move downward. As the air becomes more tightly packed together, it warms up. This warm air spreads out, usually bringing nice weather. The column of air is lower in a low pressure area compared to a nearby high pressure area.

Air moving in from a high pressure area moves in and pushes air up in a low pressure area. The rising warm air may also pick up moisture from Earth. When the warm, moist air hits cooler air higher up, it forms clouds. This is why low pressure can sometimes bring rain.





Air pressure is all around us. But, it decreases the further the air is from Earth's surface. That is why air pressure is higher over the ocean or in a valley than it is at the top of a high mountain.



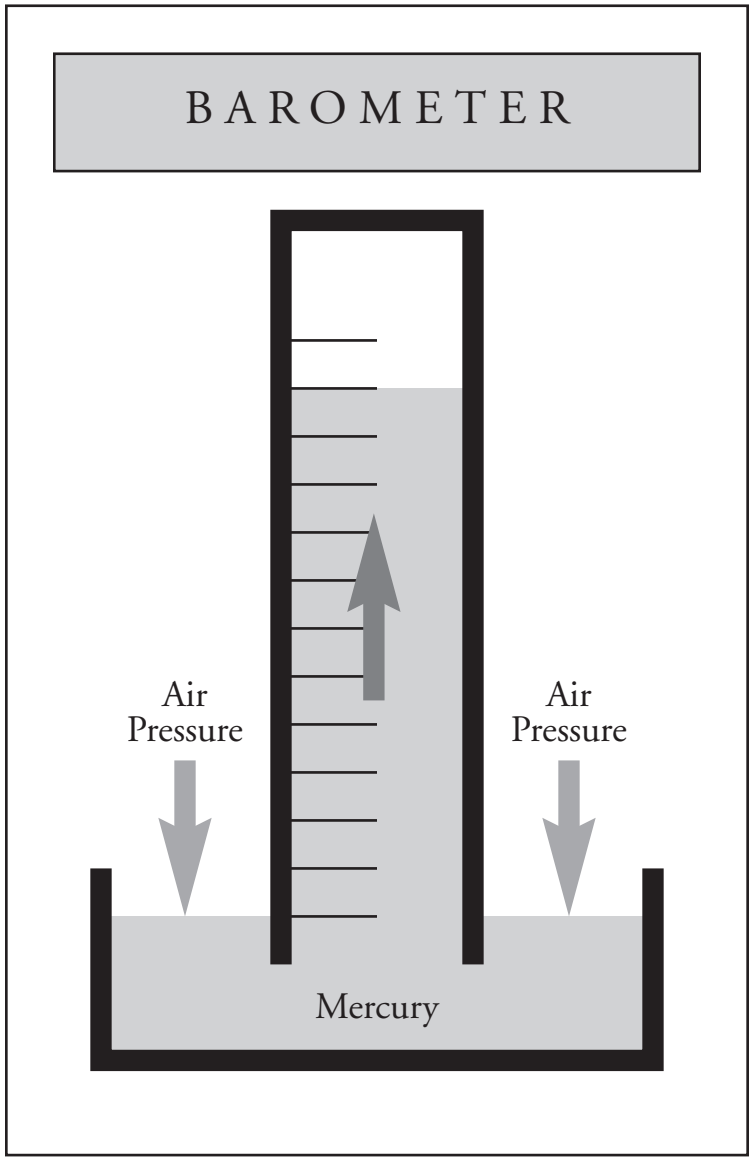
Barometers Measure Air Pressure

A barometer is a special tool. This tool measures air pressure. It was invented in 1643 by Evangelista Torricelli. He was an Italian scientist. Using this tool helps people predict the weather.

The simplest barometer is a glass tube standing in a dish of **mercury**. As the air pressure increases, it presses down on the mercury in the dish. This pushes the mercury up the glass tube. When the air pressure is lower, the mercury moves lower in the glass tube.

The tube has lines that show the level of the mercury. The lines also tell the air pressure. Tracking the changes in air pressure can warn you when the weather is about to change.

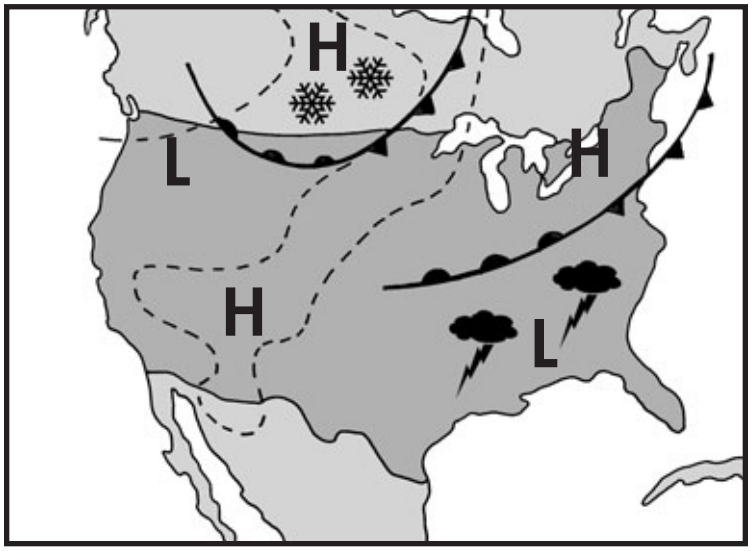
mercury: a silver-white metal; it is a liquid at room temperature



This barometer measures air pressure.
For fair weather, should the air pressure be low or high?

Predicting the Weather

Scientists use many tools to help them predict the weather. Next time you watch the weather report on TV, notice the weather maps. The symbols on the map, such as the *H*'s and *L*'s represent measurements. The *H* is for a "high pressure" area. The *L* is for a "low pressure" area. Measuring the air pressure helps predict the weather. Do you remember what type of weather high pressure usually brings?



What do you think the weather is like in the southeast?

CHAPTER 2

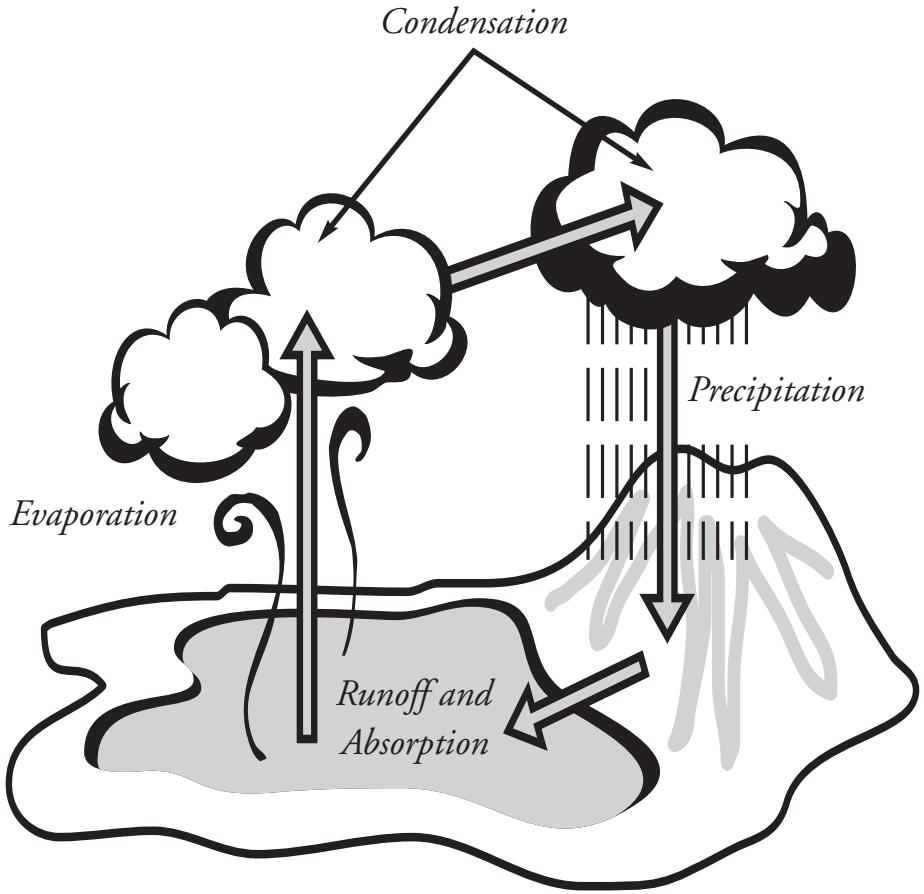
Air, Water, and Weather

The actions of air and water also affect air currents. Water from the ocean or a large lake slowly heats in the sun. When water is warmed by the sun, it **evaporates** and rises. As the water vapor rises, it cools and tiny water droplets form. When these droplets are packed closely together, they become visible and form a cloud. The clouds move toward the warmer air over the land.

Eventually, when the clouds condense, they bring rain or other forms of precipitation to the land. This process is known as the water cycle.

evaporates: changes from a liquid to a gas

Water Cycle

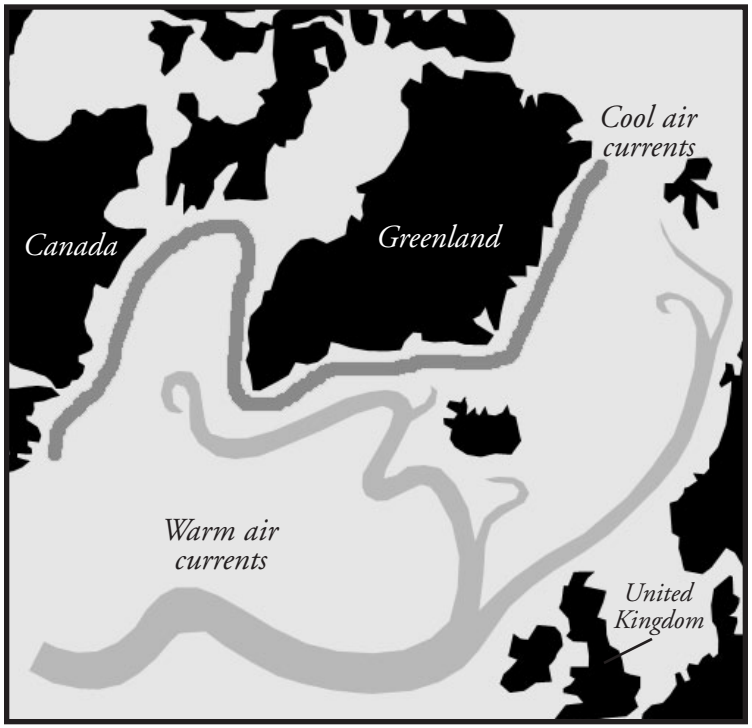


The air and water on our planet are constantly heating and cooling. These changes affect the air pressure. They create **convection currents** and ultimately change the weather. Some of these changes are predictable.

Scientists have learned that the oceans play an important role in cooling and heating Earth. The oceans are warmest at the equator where the sun strikes Earth most directly. Wind carries the warmer air north, warming the land along the coasts. Eventually, the air starts cooling off.

By the time the air reaches the poles, it is very cold. The cold air sinks and begins to move back toward the equator. At the equator, the sunlight heats the water again. The process starts over.

convection currents: currents in air and water created by temperature changes



Warm air above the ocean moves north. When it gets to Greenland and beyond, the air cools and flows south again.

CHAPTER 3

Women in Science

Weather stations are special labs where scientists study weather. Most weather stations have barometers, which you have learned about. Scientists use these and other tools to record information about the **atmosphere**. This helps them understand and predict the weather better.

Sarah Whiting started one of the early weather stations in the U.S. She was born in Wyoming, New York in 1847. At that time, most girls didn't get much education. So, when Sarah was little, she didn't get to go to school. Luckily, her father taught her all he knew about math and science.

She especially liked studying science, so she got a college degree in science. She became a teacher at Wellesley College. This is a college just for women.

atmosphere: the layer of gases surrounding Earth

Sarah really enjoyed science. She wanted to help other women learn about science, too. She thought they would learn best if they worked like real scientists in a lab. So she set up a weather station. Her students watched the sky and used tools to record information about it.

The U.S. Weather Bureau noticed the students' work. Since there were no other weather stations nearby, the Weather Bureau asked if they could use students' records. Because of Sarah, many other women also become scientists.

Sarah Whiting

Glossary

atmosphere—the layer of gases surrounding Earth

convection currents—currents in air and water created by temperature changes

evaporates—change from a liquid to a gas

gases—matter that has no shape; gases spread out to fill the space around them; most cannot be seen

invisible—not able to be seen

mercury—a silver-white metal; it is a liquid at room temperature

molecule—the smallest part of a substance

mysterious—not known or hard to explain

respiration—how living things get energy from food and oxygen

survive—to continue to live

To Find Out More . . .

Want to learn more about the air around us?

Try these books

Air Is All Around You by Franklyn Branley. Harper Colins, 2006.

The Science Book of Air by Neil Ardley. Harcourt Brace Science, 1991.

Access these Web sites

The U.S. Department of Energy, Wind Energy and Hydro Power
http://www1.eere.energy.gov/windandhydro/

The National Weather Service
http://www.nws.noaa.gov/

The National Renewable Energy Laboratory
http://www.nrel.gov/

The Environmental Protection Agency, Office of Transportation and Air Quality
http://www.epa.gov/otaq/

Write for more information

The National Weather Service
1325 East West Highway
Silver Spring, MD 20910

National Renewable Energy Laboratory
1617 Cole Blvd.
Golden, CO 80401-3393

Index

ENGLISH-LANGUAGE ARTS • GRADE 5

On Level

California Content Standards
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Comprehension and Analysis of Grade-Level-Appropriate Text: 2.3
Expository Critique: 2.5

English-language Arts Activities

The Air Around Us

Print pages 20–24 of this PDF for the reading activities.

Steps in a Process

Understanding the steps in a process can help you understand and remember what you read. You can summarize the steps in a process using words such as *first, then, next,* and *finally.*

Read this passage and try to identify the steps in the process.

The actions of air and water also affect air currents. Water from the ocean or a large lake slowly heats in the sun. This causes evaporation. The rising water molecules form clouds of cooler air. The clouds move toward the warmer air over the land. Eventually, when the clouds condense, they bring rain or other forms of precipitation to the land.

A graphic organizer can help you identify the steps.

Step 1	First, air from the ocean or a large lake slowly heats in the sun. This causes evaporation.
Step 2	Next, the rising water molecules form clouds of cooler air.
Step 3	Then, the clouds move toward the warmer air over the land.
Step 4	Finally, when the clouds condense, they bring rain or other forms of precipitation to the land.

TRY THE SKILL

Read this passage from *The Air Around Us*. Try to identify the steps in the process. Use the graphic organizer to help you.

The oceans are warmest at the equator where the sun strikes Earth most directly. Wind carries the warmer air north, warming the land along the coasts. Eventually, the air starts cooling off. By the time the air reaches the poles, it is very cold. The cold air sinks and begins to move back toward the equator. At the equator, the sunlight heats the water again.

Step 1	
Step 2	
Step 3	
Step 4	

Fact and Opinion

A fact is something that has been proven to be true. An opinion is someone's point of view and is not usually something that can be proved. Instead, an opinion gives a person's preference or describes their feelings.

Most of the statements in *The Air Around Us* are facts but not all. Which statement from *The Air Around Us* is a fact? Which is an opinion?

1. A gentle, summer breeze cools you down on a hot day.
2. The air is made of gases.

The first statement is an opinion. Some people will feel cooled by the breeze, but others will prefer a different way to cool down.

The second statement is a fact. Scientists can prove that the air is made of gases.

TRY THE SKILL

Read the statements below. Write an "F" beside the statements that are facts. Write an "O" beside the statements that are opinions.

___ **1**. The air we breathe is mostly made of nitrogen and oxygen.

___ **2**. When air molecules are packed close together, the molecules are at high pressure.

___ **3**. The best weather is sunny with light puffy clouds.

___ **4**. Air pressure decreases the further the air is from Earth's surface.

___ **5**. The air and water on our planet are constantly heating and cooling.

___ **6**. Everyone admires Sarah Whiting.

Table of Contents

The table of contents tells the reader what information is in the book. It also tells what page number the reader can start reading on to find the information.

Read the beginning of the table of contents from this book about air.

What page would you begin reading to find information about how to turn air into energy?

Page 12, because the subheading on page 12 is "Air Turns into Energy."

What chapter would you read to find information about how to turn air into energy?

Chapter 1, because the subheading "Air Turns into Energy is contained in Chapter 1.

TRY THE SKILL

Read the beginning of the table of contents again. Shade the circle next to the answer.

1. What page would you begin reading to find information about predicting the weather?
   - Ⓐ Page 5
   - Ⓑ Page 14
   - Ⓒ Page 17
2. Which chapter would you read to find information about predicting the weather?
   - Ⓐ Introduction
   - Ⓑ Chapter 1
   - Ⓒ Chapter 2
3. What page would you begin reading to find information on air in motion?
   - Ⓐ Page 6
   - Ⓑ Page 8
   - Ⓒ Page 12
4. Which chapter would you read to find information on air in motion?
   - Ⓐ Introduction
   - Ⓑ Chapter 1
   - Ⓒ Chapter 2

Main Idea and Supporting Details

The main idea is the author's main point. A supporting detail tells more about the main idea.

Read this passage. The graphic organizer below shows the main idea and supporting details.

How can we be sure that air exists? Even though we can't see air we know it exists, because it takes up space.

Imagine the last time you blew up a balloon. Before you blew up the balloon, it was flat and wrinkly. After you blew it up, the balloon was big and smooth. What was inside the balloon that made the balloon hold its shape? The balloon was full of air.

Main Idea	Supporting Details
We know air exists because it takes up space.	• A balloon with no air in it is flat and wrinkly. • A balloon with air in it is big and smooth.

TRY THE SKILL

Read this passage from the book.

Air is made up of gases. The air we breathe is mostly made of nitrogen and oxygen. There are very small amounts of other gases, too—such as argon, and carbon dioxide. You can not see these gases, but they are there. We need them to survive.

Now complete this graphic organizer.

Main Idea	Supporting Details

Answer Key

Steps in a Process

First, wind carries the warmer air north, warming the land along the coasts.

Next, the air starts cooling off. By the time it reaches the poles, it is very cold.

Then, the cold air sinks and begins to move back toward the equators.

Finally, at the equator, the sunlight heats the water again.

Fact and Opinion

1. F

2. F

3. O

4. F

5. F

6. O

Table of Contents

1. C

2. C

3. B

4. B

Main Idea and Supporting Details

Main Idea

Air is made up of gases.

Supporting Details

- The air we breathe is mostly made of nitrogen and oxygen.
- There are very small amounts of other gases too—like argon and carbon dioxide.
- You can not see these gases, but they are there.
- We need gases to survive.