SCIENCE • GRADE 5

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

Above 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

1.0 WORD ANALYSIS, FLUENCY, AND SYSTEMATIC VOCABULARY DEVELOPMENT

***Vocabulary and Concept Development 1.4*—**Know abstract, derived roots and affixes from Greek and Latin and use this knowledge to analyze the meaning of complex words (e.g., controversial).

2.0 READING COMPREHENSION

***Structural Features of Informational Material 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 2.3*—**Discern main ideas and concepts presented in texts, identifying and assessing evidence that supports those ideas.

***Comprehension and Analysis of Grade-Level-Appropriate Text 2.4*—**Draw inferences, conclusions, or generalizations about text and support them with textual evidence and prior knowledge.

SCIENCE • GRADE 5

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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.

AL

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).

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FOCUS ON CALIFORNIA STANDARDS

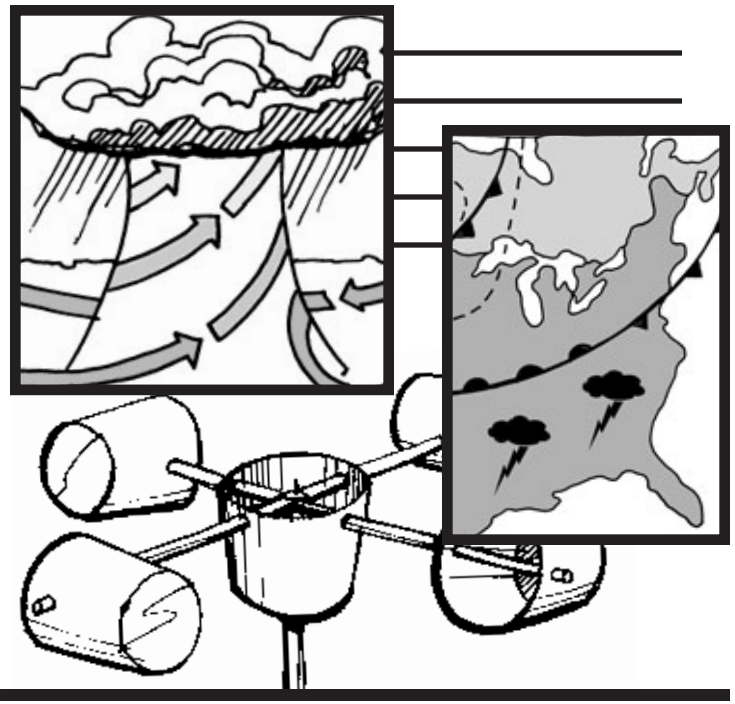
SCIENCE • GRADE 5

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

The Air Around Us

by

Caitlin Scott



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Curriculum materials for **your** content standards

Table of Contents

What do you think you will learn from this book?

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 and life on this planet would cease to exist. What can this **mysterious**, unseen substance be? If you guessed that the mystery substance is air, your answer was correct.

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

Think back to the last time you inflated a balloon. Before you blew it up, the balloon was flat and wrinkly. As you blew into the balloon, it inflated, gradually 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 try to 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 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 or feel 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

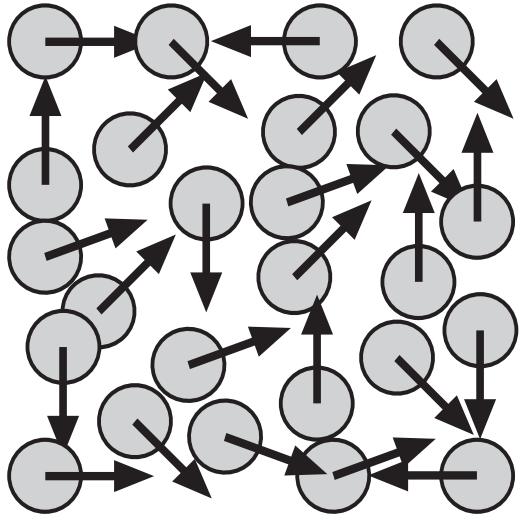
A gentle, summer breeze cools you down on a hot day. A strong wind is excellent for kite flying. Storm winds, like tornados or hurricanes, can uproot trees and destroy buildings. But why does the wind blow in the first place? One of the causes of wind is air pressure.

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

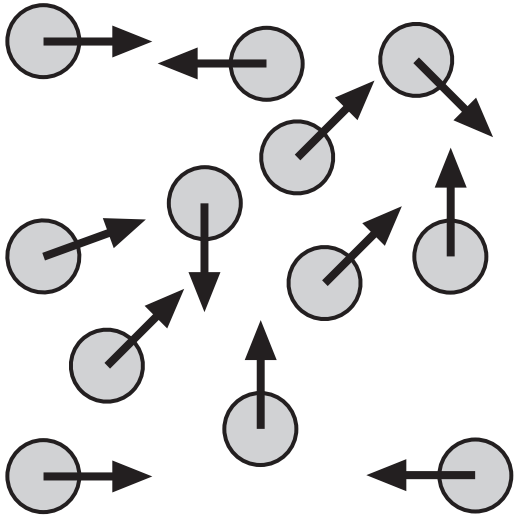
When air **molecules** are packed close together, the molecules are at high pressure, but when the molecules are spread out, they are at low pressure. For example, the air molecules inside a balloon are packed tightly together. The molecules inside the balloon are at a higher pressure than those outside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

molecule: the smallest part of a substance

Air Molecules Under High Pressure



Air Molecules Under Low Pressure

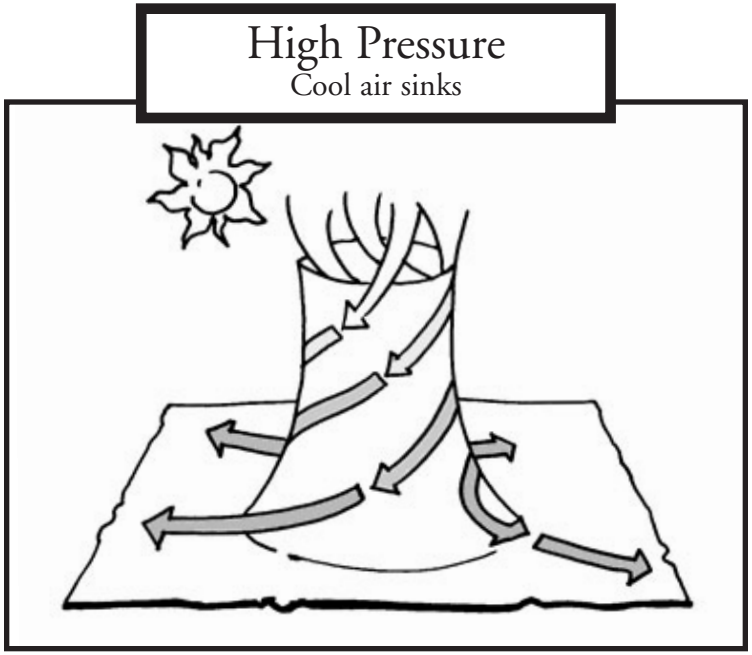


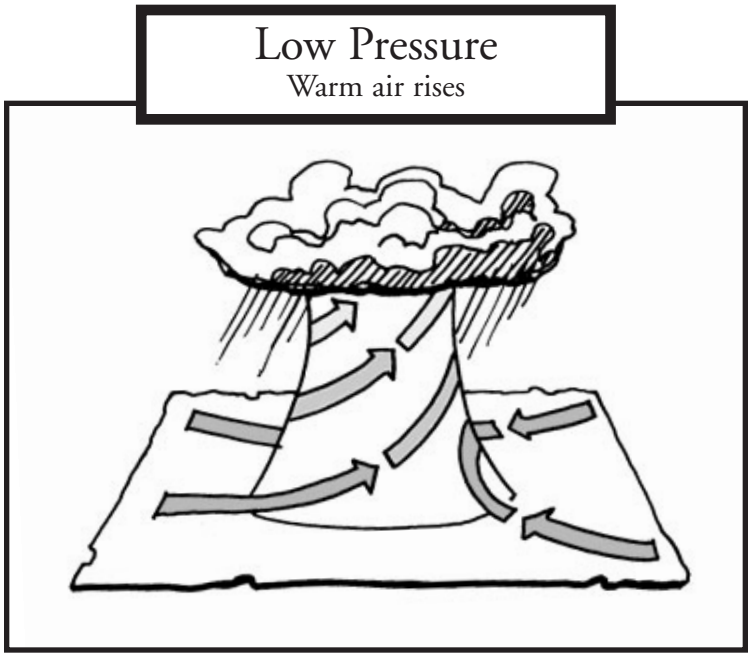
Air Pressure Changes

After studying changes in air pressure, scientists have discovered that air pressure can help us predict the weather. When the weather changes, air pressure typically changes at the same time. A drop in air pressure usually means bad weather, while rising air pressure often means good weather.

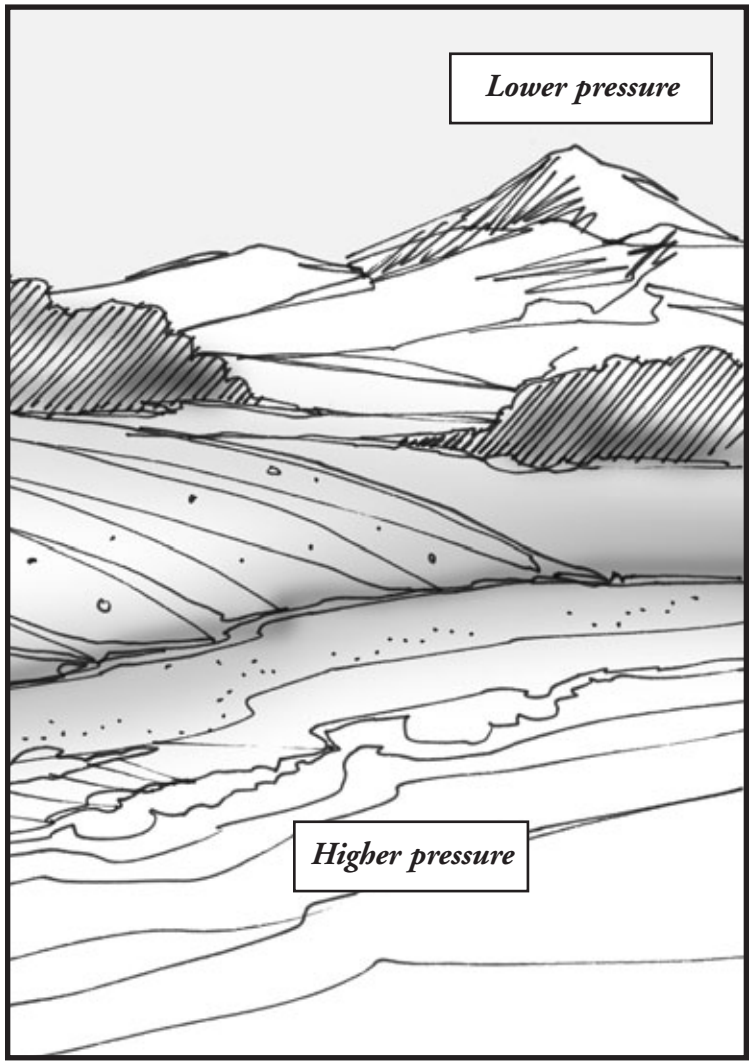
The column of air is higher and heavier in a high pressure area. This causes the air to move downward. As the air becomes more tightly packed together, it warms up. This warm air spreads out, usually bringing nice weather.

The column of air is lower in a low pressure area compared to an adjoining 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 the reason the air pressure is higher over the ocean or in a valley than it is at the top of a high mountain.



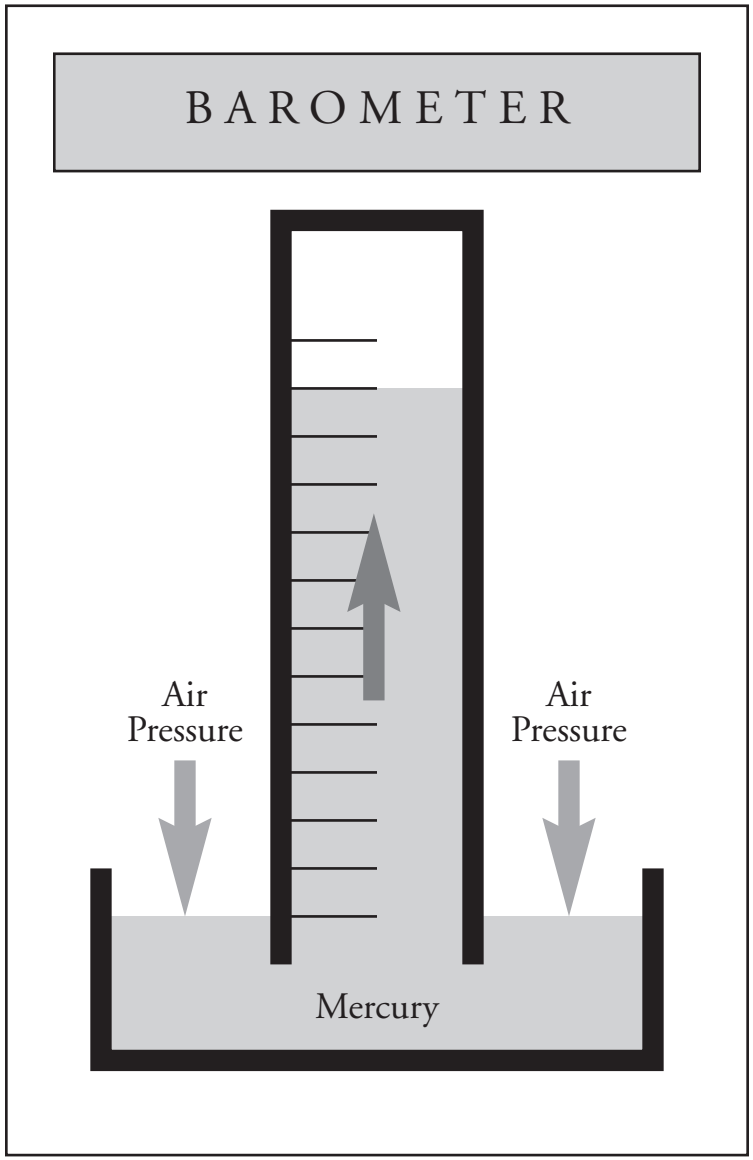
Barometers Measure Air Pressure

A barometer is a special tool for measuring air pressure. It was invented in 1643 by Evangelista Torricelli, an Italian scientist. Using a barometer makes it easier for people to predict the weather.

The simplest kind of 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 glass tube has lines on it to measure the level of the mercury. These lines give us a measure of air pressure. Tracking the changes in air pressure using a barometer can warn you when the weather is about to change.

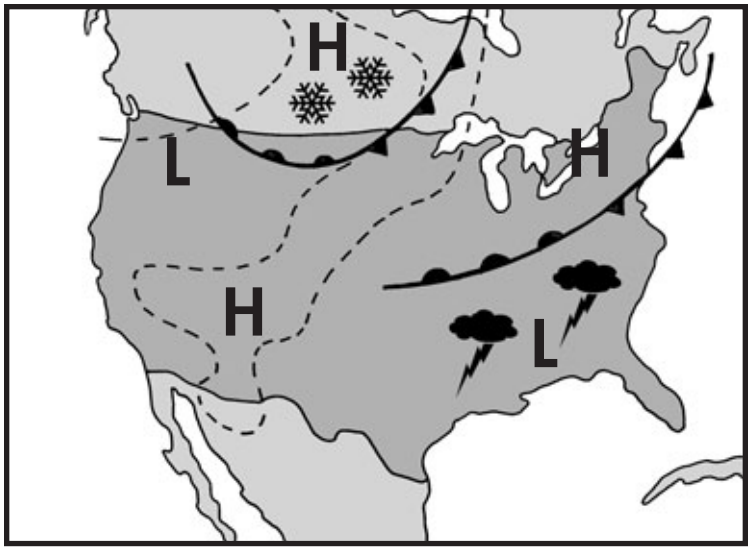
mercury: a silver-white metal; it is a liquid at room temperature



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

Predicting the Weather

Scientists use barometers and many other tools to help them predict the weather. Next time you watch the weather report on TV, you should notice the weather maps. The symbols on the map, such as the *H*'s and *L*'s represent measurements. The *H* indicates a "high pressure" area, while the *L* shows 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

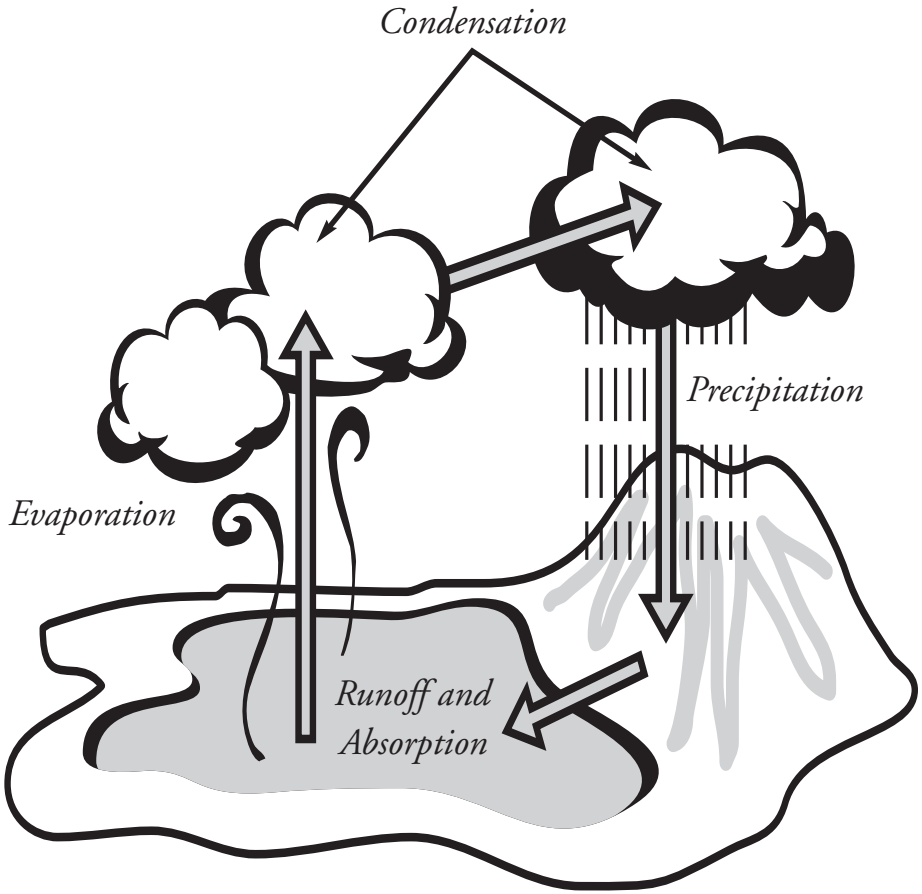
Air, Water, and Weather

The actions of air and water also affect air currents. Water from a large body of water like 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 gradually toward the warmer air over the land.

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

evaporates: changes from a liquid to a gas

Water Cycle

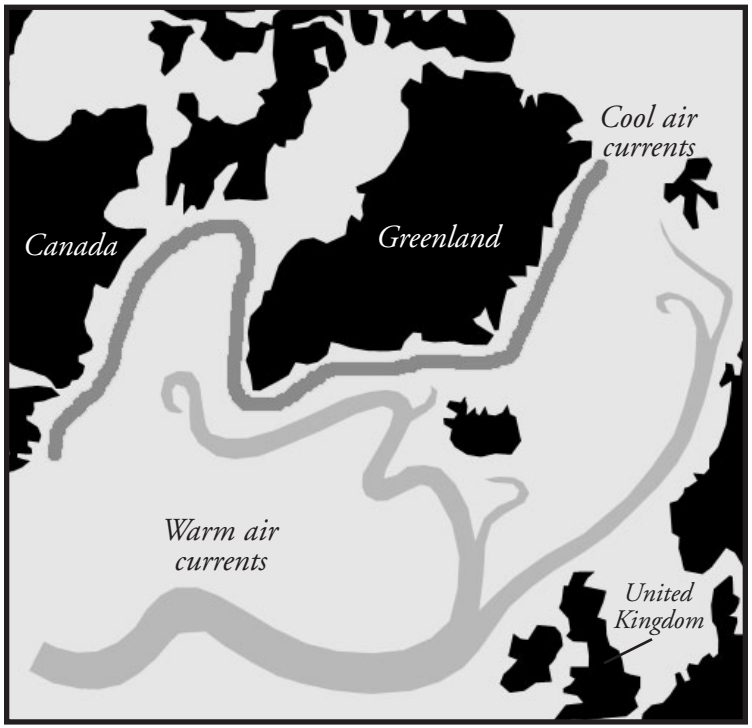


The air and water on planet Earth are continually heating and cooling causing changes that affect the air pressure. They create **convection currents** and ultimately change the weather. Some of these changes are predictable.

Scientists have learned that the oceans play an extremely 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 frigid. This cold air sinks and begins to move back toward the equator. At the equator, the strong sunlight begins heating 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 laboratories where scientists study weather. Most weather stations have barometers and anemometers, which you have learned about. Scientists use these and other tools to record information about the **atmosphere**. Ultimately, 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, when most girls didn't get much education. So, when Sarah was little, she didn't get to go to school. Fortunately, 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, which is a college just for women.

atmosphere: the layer of gases surrounding Earth

Sarah really enjoyed science, so she wanted to help other women learn about science, too. She thought they would learn best if they worked like real scientists in laboratories, so she set up a weather station. Her students observed the sky closely 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—changes 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

Above Level

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English-language Arts Activities

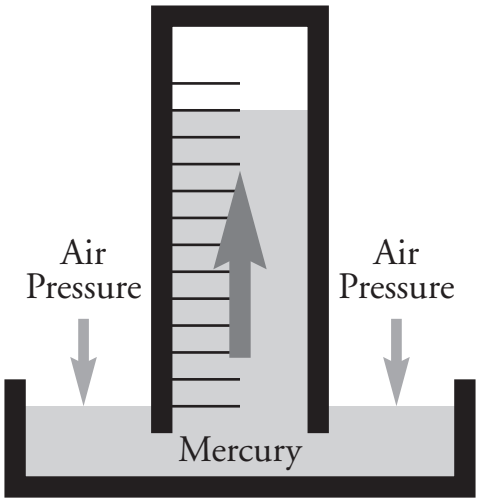
The Air Around Us

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

Interpret Graphics

Graphics can give you information quickly and help you understand how something works. Look at this graphic of a barometer.

BAROMETER



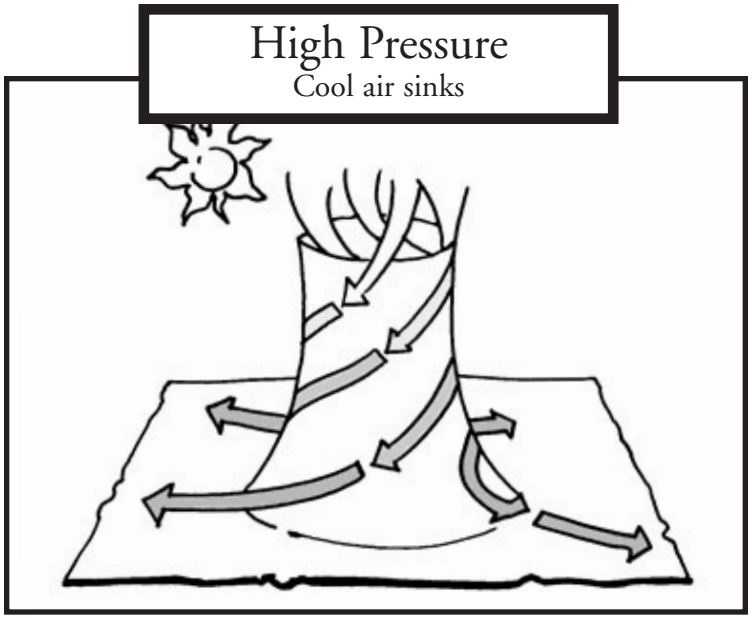
How does a barometer work?

Here is some information you interpret from the graphic.

- Air pressure pushes down on the mercury in the dish.
- The pressure of the air moves the mercury up the glass tube.
- The lines on the glass tube measure the air pressure.

TRY THE SKILL

Study this graphic about high air pressure. What happens in a high pressure area?



_____

_____

_____

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Make Predictions

TRY THE SKILL

You can use facts in informational writing to determine what will happen next. Read this paragraph.

When air cools, it moves down causing higher air pressure. As the air becomes more tightly packed together, it warms up. This warm air spreads out...

What kind of weather is likely to be caused by rising air pressure?

Remember that higher air pressure usually means good weather.

Now read this paragraph from a story.

John was getting ready to take his sailboat out on Lake Michigan, but his father stopped him. He pointed to the barometer in the hall. The air pressure had fallen a lot from yesterday. John was disappointed.

Why was John disappointed?

Falling air pressure usually means bad weather.

Read the paragraph. Answer the questions.

When air is warm, it rises and becomes less tightly packed together, causing lower pressure. The rising warm air may also pick up moisture from Earth. When the warm, moist air hits cooler air higher up, it forms clouds.

1. What kind of weather is likely to be caused by falling air pressure? _____

Now read this paragraph and answer the question.

When Maria woke up, the sky was pretty cloudy. She sighed and rolled over to go back to sleep. The picnic would probably be rained out. Just then her mother called out that the weather was on TV. Maria leaped out of bed. She was in time to see a map of the state. There was a large *H* over her town marking a high pressure area.

2. What does the symbol *H* mean about the weather?

_____

Draw Conclusions

When you read, think about what you read and draw conclusions. Facts from the book should support these conclusions.

Here is a paragraph from *The Air Around Us*. The graphic organizer shows one conclusion you might draw. It also shows the facts that support this conclusion.

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.

Conclusion

Air pressure plays an important part in weather.

Facts

- When air is tightly packed, it warms up.
- Warm air spreads out.
- This brings nice weather.

TRY THE SKILL

Read this paragraph and complete the graphic organizer.

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

Conclusion

Facts

Prefixes

Prefixes are short syllables at the beginning of words that can change the meaning of the word. Knowing prefixes can help you learn the meaning of new words. The prefixes *in-, im-,* and *un-* often change a word into its opposite.

Read the following paragraphs from *The Air Around Us* and find words that begin with these prefixes.

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 and life on this planet would cease to exist. What can this mysterious, unseen substance be? If you guessed that the mystery substance is air, your answer was correct.

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

What does the word *invisible* mean? Use the prefix.

The prefix *in-* means "not." *Invisible* means the opposite of *visible*. It means "not visible," or "not able to be seen."

TRY THE SKILL

Read the passage again. Find two more words that use the prefix *in-, im-,* or *un-*. Write the word and the definition in the chart.

Word	Definition

Now complete this chart with new words using the prefix *in-, im-,* and *un-* by giving a definition for these words.

Word	Definition
incorrect	
imbalanced	
unheard	
incomplete	
imperfect	
unpleasant	

Answer Key

Interpret Graphics

Answers will vary, but should include: "In a high pressure area, cool air sinks and spreads out across the land. This usually brings good weather."

Make Predictions

Answers will vary but may include:

1. Falling air pressure usually means bad weather and may bring rain.
2. An *H* means a high pressure area. This usually means good weather.

Draw Conclusions

Conclusion: Sarah helped many women become scientists.

Facts:

- Sarah really enjoyed science, so she wanted to help other women learn about science, too.
- Her students observed the sky closely and used tools to record information about it.
- She thought they would learn best if they did work like real scientists in laboratories, so she set up a weather station.

Prefixes

1. unseen: not able to be seen
   impossible: not possible
2. incorrect: not correct
   imbalanced: not balanced
   unheard: not able to be heard
   incomplete: not completed or finished
   imperfect: not perfect
   unpleasant: not pleasant