ELA GRADE 4

Spring break learning

March 10-14 2025

The Office of Literacy

Spring Break
Learning Academy

STUDENT RESOURCES

The materials contained in this packet provides students with additional practice reading, speaking, listening, and writing. Students can return the completed packet to their teacher for review. The materials are organized as follows:

Table of Contents

Reading/Writing Companion

Shared Read Text

Name ______________________________

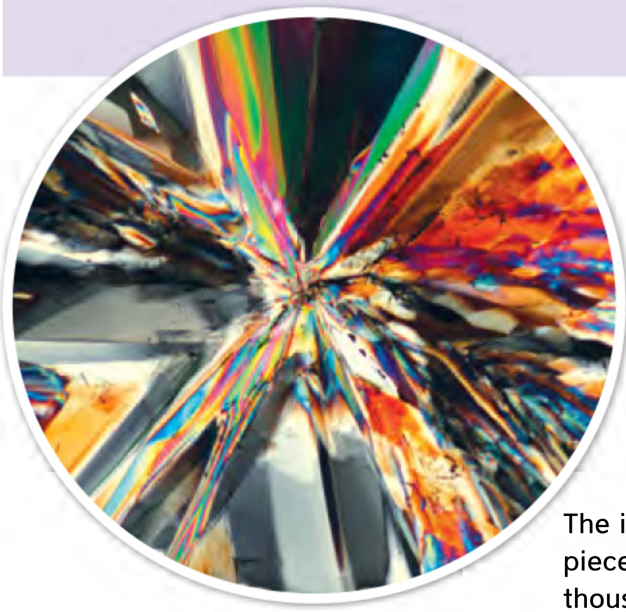
Your World Up Close

1 Main Question

Look at the picture. What does it show? How was the picture taken, or made?

What does the picture on the left show? Is it a diamond or a piece of glass? Take a step back. You are too close.

It is a picture of a tiny piece of sugar. This **close-up picture was taken with** an electron microscope. An electron microscope is a tool that can **magnify something** to **thousands of times** its real size.



The image shows a piece of sugar magnified thousands of times.

Glossary

close-up picture *(acercamiento)* a picture that is taken very close, so you can see lots of small details

was taken with *(se tomó)* was created by

magnify something *(aumentar algo)* make something look bigger than it really is

thousands of times *(miles de veces)* a much larger size than

Additional Questions

1. **What does the author ask about the picture?**

   The author asks if the picture shows a ______________ or a piece of ______________.

2. **Why does the author say "Take a step back"?**

   You are ______________ to figure out what the picture ______________.

3. **What does the picture show?**

   It shows a ______________ of a piece of ______________.

4. **What does a close-up picture show?**

   It shows a lot of small ______________.

5. **How was the picture taken, or made?**

   It was ______________ with an ______________.

6. **What is an electron microscope? What can it do?**

   It is a ______________. It can ______________ something. It makes things look ______________ of times ______________ than their ______________.

Word Bank

glass
taken
diamond
thousands
close-up
electron microscope
too close
sugar
real size
magnify
bigger
tool
details
shows

Main Question 1 Revisited

Look at the picture. What does it show? How was the picture taken, or made?

____

____

____

____

2 Main Question

The electron microscope takes special pictures. What are they called? Why are they special?

Pictures taken with an electron microscope are called photomicrographs. The word *micro* means "small." **Even though** the piece of sugar looks large, we are seeing a small part of the piece of sugar close up.

Glossary

even though *(a pesar de que)* though; despite the fact that

COLLABORATE Additional Questions

1. **What is a photomicrograph?**

   It is a picture ______________ with an ______________________.

2. **Photomicrographs has the word micro in it. What do photomicrographs show?**

   They show pictures of very __________________ things.

Word Bank

large
close up
part
seeing
electron microscope
small
taken

3 **How does the piece of sugar look in the photomicrograph?**

The piece of sugar looks ________________.

4 **What are we seeing in the photomicrograph?**

We are ______________ a small ______________ of the piece of sugar. We are seeing it ____________________.

Main Question 2 Revisited

The electron microscope takes special pictures. What are they called? Why are they special?

____

____

____

____

3 Main Question

The author explains the history of photomicrographs. How did they start? How did they develop, or change?

Photomicrographs **date back to** 1840. The scientist Alfred Donné first photographed **images** through a microscope in 1840. Around 1852, a German scientist made a camera that took photomicrographs. In 1882, Wilson "Snowflake" Bentley was the first person to use a camera with a **built-in microscope**. He took pictures of snowflakes. His photographs showed that each snowflake is different.

Wilson Bentley's photograph's showed that snowflakes have six sides.

Glossary

date back to *(se remontan a)* began around the time of

images *(imágenes)* pictures

built-in microscope *(microscopio integrado)* microscope that was attached to the camera

COLLABORATE Additional Questions

1 When were the first photomicrographs made?

They were first ______________ in ______________.

2 What did Alfred Donné do?

He photographed, or __________ pictures, through a

______________________.

3 **What happened around, or close to, 1852?**

A German scientist made a ______________. It took ______________________________.

4 **What happened in 1882?**

Wilson Bentley used a ____________________ with a ____________________________ microscope.

5 **What did Bentley take pictures of?**

He took pictures of _____________________________.

6 **What did his photographs show?**

Each snowflake was ____________________________.

7 **What did Bentley's photographs show about showflakes?**

They showed that ________________________ have ______________________________.

Word Bank

made
1840
took
camera
microscope
built-in
different
snowflakes
photomicrographs
six sides

Main Question 3 Revisited

The author explains the history of photomicrographs. How did they start? How did they develop, or change?

____

____

____

____

4 Main Question

Electron microscopes are different from the microscopes in school. How are they different?

The microscopes you use in school are not **powerful**. They do not show much **detail**. An electron microscope is very powerful. Scientists can see tiny details of the skin.

The pictures below are close-ups of human skin. They show the detail an electron microscope can **capture**. The more the picture is magnified, the more detail you see. A photomicrograph can show something that has been magnified to about 2 million times its real size.

Glossary

powerful *(potentes)* strong

detail *(detalle)* the small parts and pieces of something

capture *(capturar)* show in a picture

This is a human fingerprint, magnified by an electron microscope.

COLLABORATE

Additional Questions

1. **Why are the microscopes you use in school not powerful?**

   They are not ______________ because they do ______________ much detail.

2. **How is an electron microscope different?**

   It is ______________ powerful.

3. **How is an electron microscope powerful?**

   It can show ________ details of the ______________.

4. **What do the pictures show? How were they taken?**

   They are ______________ of ______________. They were taken with an ______________________.

5. **What happens when you magnify a picture more?**

   You can see ______________ details.

6. **How much can a photomicrograph magnify?**

   It can ______________ something to ______________ times its ______________.

Word Bank

- 2 million
- more
- electron microscope
- very
- magnify
- close-ups
- tiny
- real size
- fingerprints
- powerful
- skin
- not show

Main Question 4 Revisited

Electron microscopes are different from the microscopes in school. How are they different?

____

____

____

____

5 Main Question

Scientists use magnified images. How do scientists use them?

Magnified images have helped scientists find out the causes of some **diseases**. Over the years, scientists have learned how to **treat** diseases from the way they **behave**.

Glossary

diseases *(enfermedades)* sicknesses or illnesses

treat *(tratar)* get better, cure or end

behave *(comportan)* act; do what they do

Additional Questions

1 How did magnified images help scientists?

They help scientists find the ______________

of ______________.

2 How can learning the cause of diseases help scientists?

They can ______________ the ______________.

Word Bank

treat

behave

sick

diseases

causes

better

3 **What happens when scientists treat a disease?**

The ______________ person gets _________________.

4 **How did scientists learn to treat diseases?**

Scientists studied how ______________ act, or

__________________.

Main Question 5 Revisited

Scientists use magnified images. How do scientists use them?

____

____

____

____

6 Main Question

Scientists use electron micrographs to see how objects change. Why do they use them?

Scientists use electron micrographs to see how **objects** change **over time**. For example, they can look at a piece of fruit to see how it **spoils**. First it looks **fresh**. After a few days, it gets soft. **Eventually** the fruit is covered in mold. **Under the microscope**, these changes **show up** sooner than when you see them with **just your eyes**.

Glossary

objects *(objetos)* things

over time *(con el tiempo)* in weeks, months, or years

spoils *(echa a perder)* goes bad; becomes too ripe

fresh *(fresca)* new and young

Eventually *(eventualmente)* after an amount of time

under the microscope *(bajo el microscopio)* when you use a microscope

show up *(se ven)* are visible

just your eyes *(solamente con los ojos)* only your eyes

COLLABORATE Additional Questions

1. **How do scientists use electron micrographs?**

   Scientists use them to see objects ______________ over ______________.

2. **What changes do the scientists see?**

   Scientists ______________ how ______________ fruit ______________.

3. **How does the fruit look at first?**

   It looks ______________.

4. **What happens after a few days?**

   It gets ______________.

5. **What happens when the fruit spoils?**

   The fruit is ______________ in ______________.

6. **Why is it helpful to look at the magnified images under a microscope?**

   Scientists can see the changes ______________ than seeing them with ______________.

Word Bank

mold
sooner
soft
fresh
time
spoils
look at
ripe
covered
their eyes
change

Main Question 6 Revisited

Scientists use electron micrographs to see how objects change. Why do they use them?

____

____

____

____

7 Main Question

The author asks a question at the end. What does the author ask?

> Think about the things you want to see magnified. What things in our world do you want to see close up?

COLLABORATE

Additional Questions

1. **Why does the author ask the question?**

   When we look at things ____________________, we can ____________________ about them.

2. **What does the author ask you to do?**

   The author tells us to think about what we want to see ____________________.

Word Bank

- magnified
- close up
- learn more

Main Question 7 Revisited

The author asks a question at the end. What does the author ask?

____

____

____

____

Comprehension Skill

Sequence How does the author use sequence to explain what scientists see? How does the author use dates to explain how they invented photomicrographs?

Sequence is the order of the events and ideas in a text. Authors use sequence to organize events and ideas in the order they happened. They use words that **signal** time, such as *first, after, eventually,* and *over the years*. Authors can also use dates to show sequence.

Glossary

signal *(indican)* show

COLLABORATE

Practice

1. The author uses ______________ to explain how fruit spoils ______________. The author uses words that ______________ time. ______________, the fruit looks ______________. ______________, it gets ______________. ______________, it is ______________ in ______________.

2. **Extension:** The author explains how ______________ were invented, or created. In 1840, a scientist ______________ took

Word Bank

sequence

signal

photographs through a ______________________.

Around 1852, ______________________________

______________________________________.

In __________, ________________________

____________________________. He used ______

______________________________________.

Comprehension Skill Revisited

Sequence How does the author use sequence to explain what scientists see? How does the author use dates to explain how they invented photomicrographs?

____

____

____

____

____

COLLABORATE

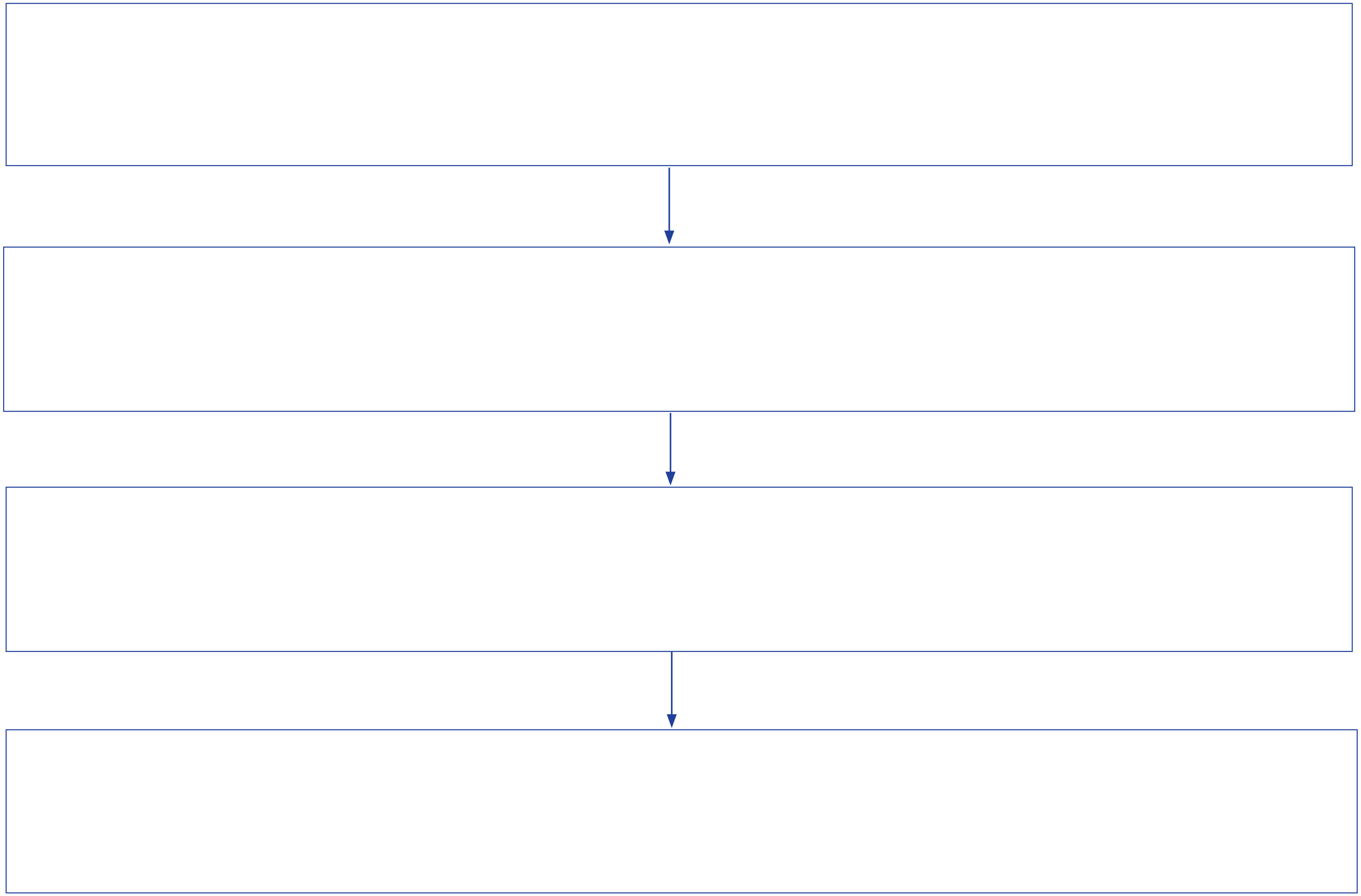
Reread As you reread the text, use the graphic organizer to describe how scientists invented photomicrographs.

Summarize

COLLABORATE

Talk with a partner to summarize important details in "Your World Up Close."

Title ______________________________ Name ______________________________



GLOSSARY

Title ______________________ Name ______________________

Word/ Translation	Your Definition	Page Number	Your Sentence or Example

Literature Anthology

Anchor Text

Genre • Expository Text

Essential Question

What can you discover when you look at something closely?

Read about water molecules and how they change.

Go Digital!

A DROP

OF WATER

BY WALTER WICK

MOLECULES IN MOTION

If a drop of water is added to a jar of still water, and if the water in the jar is not stirred, where will the new drop go? Will it stay near the top or sink to the bottom? A simple experiment reveals the answer.

A drop of blue water enters a jar of clear water. It begins to split up. Parts of the drop sink and swirl in different directions. At last, the colored drop breaks into so many parts that it has become part of the whole jar of water.

The molecules in a liquid are moving all the time, pushing and pulling each other, attaching to and breaking away from neighboring molecules. The molecules in the blue drop break apart because they are pushed and pulled all over the jar by other water molecules. The energy that keeps the molecules moving is heat. This heat can come from the sun or the room in which the jar is standing. Without heat, water would not remain a liquid.

ICE

When water cools, it loses energy. The molecules slow down and eventually stop swirling and pushing each other. When water freezes, the molecules lock together, forming a rigid structure. A drop of blue water no longer moves. The water has changed from a liquid to a solid—ice.

Ice is a solid, like metal or rock. But, unlike metal or rock, ice is solid only at temperatures of 32 degrees Fahrenheit (0 degrees Celsius) or colder. At room temperature, ice melts, changing back to a liquid.

STOP AND CHECK

Summarize Explain how ice forms. Include text details.

WATER VAPOR

Water always seems to be disappearing: from wet clothes on a line, from puddles on the ground, and from dishes on a draining board. We say it has dried up, but where has the water gone?

Just as water can be a liquid or solid, it can also be a gas. The water from the wet dishes *evaporates*. That is, it turns into a gas called *water vapor*. Molecule by molecule, the water from the drops on the wet dishes drifts invisibly into the air.

Heating water in a kettle speeds evaporation. Heat from the stove makes the water turn to steam, which is extremely hot water vapor. When the steam hits the cooler air, tiny droplets form, and we see a cloud just beyond the kettle's spout. Almost immediately, the droplets evaporate and change back to invisible vapor. Then the water molecules **mingle** with other molecules that make up air.

CONDENSATION

The air around us always contains some water vapor. Water molecules move rapidly through the air and hit everything in their paths. The molecules bounce off most warm surfaces, but stick to surfaces that are cold. In these photographs, molecules of water vapor stick to the coldest part of the glass. Gradually, droplets form on the glass as the molecules accumulate. Water vapor changes from a gas to a liquid; that is, it *condenses.*

STOP AND CHECK

Summarize How does condensation form? Summarize using details from the text.

EVAPORATION VERSUS CONDENSATION

In the photographs above, why do the water drops outside this glass disappear, while the drops inside remain?

Outside the glass, the water evaporates and spreads throughout the room as vapor. In time, the drops disappear. Inside the glass, water also evaporates, but the vapor is trapped. The air inside the glass becomes ***humid***, which means that the air is full of water vapor. And that vapor condenses back onto the water drops as quickly as water molecules can evaporate. Therefore, the drops remain.

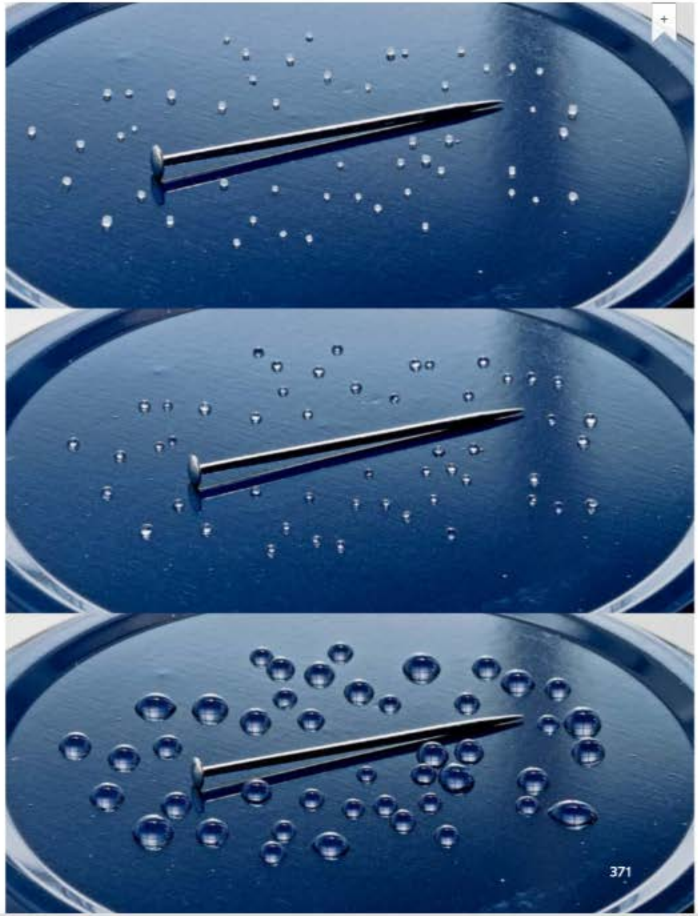
Remove the glass, and the vapor expands throughout the room. Evaporation continues, but condensation slows down. In time, the uncovered drops will disappear.

HOW CLOUDS FORM

Clouds are made of tiny water droplets, too small to be seen without a microscope. If a cloud droplet is to form, water vapor must first condense on a particle of dust. Carried by wind, these dust particles are often bits of pollen, soot, soil, or salt.

This experiment shows how cloud droplets form. Salt is placed on a jar lid above a dish of water. A glass cover traps the water vapor. In minutes, the vapor condenses on the salt and coats each grain with water. Hours later, the salt dissolves in the water drops.

Clouds form when water evaporates from the earth's surface and rises into colder air. There, the vapor condenses on cold, airborne particles. More and more molecules cling to the particles until droplets form. It takes about a million cloud droplets to make one raindrop. Rain does not taste salty or appear gritty because the particles that allow clouds to form are usually too small to be noticed in raindrops.



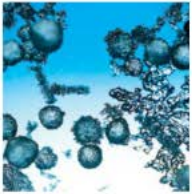
SNOWFLAKES

This snowflake is shown 60 times its actual size. The angles between the six major branches are repeated over and over again in many of the smaller details of this amazing structure. How can such an intricate object form in the sky?

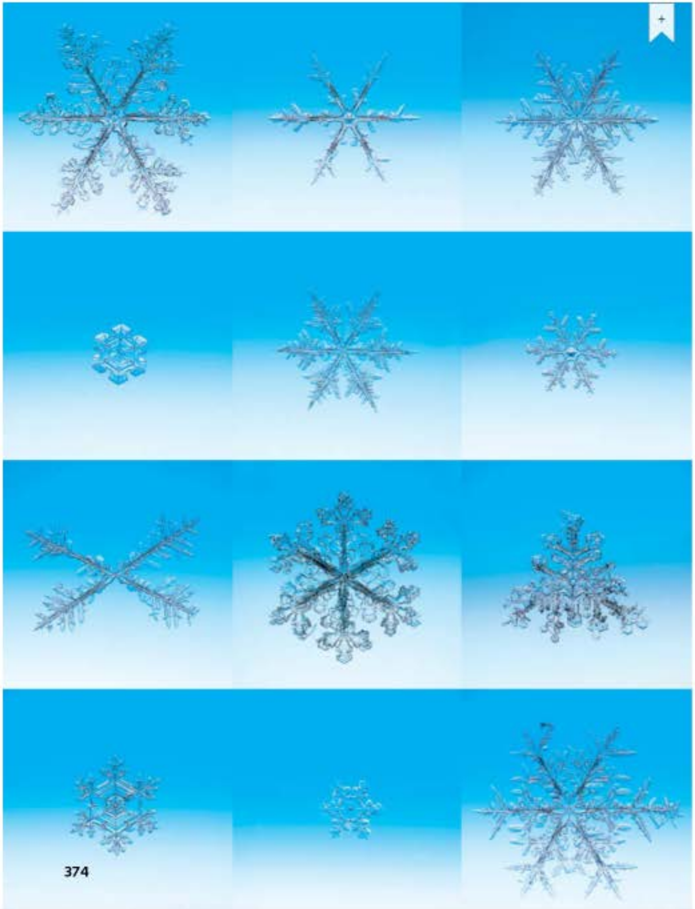
Cloud droplets form when water vapor condenses on particles. But in very cold air, water molecules that cling to particles form tiny ice crystals. As more water molecules from the air freeze onto the crystal, they join at angles that allow a six-sided structure to form. If the crystal grows large enough, it will fall to the ground as a snowflake.

Clouds that produce snow often contain both ice crystals *and* liquid droplets. At the center of this snowflake is a cloud droplet that froze, allowing the snowflake to form around it. Scattered throughout are other cloud droplets that have frozen onto the snowflake as it fell through the cloud.

Sometimes snow mixes with pellets of sleet, which are frozen raindrops like the ones shown below. By contrast, snowflakes are ice crystals that form when water vapor changes directly from a gas to a solid.



Sleet, 15 times actual size



ENDLESS VARIETY

Many ice crystals grow into shapes that are just tiny slivers, rods, or clumps of ice. Of these, the underlying six-sided structure may not always be visible. But when weather conditions are just right, the crystals will grow into an astonishing variety of elaborate six-sided designs.

All the snowflakes on these two pages were photographed on the same day. All share the same angles, but vary in design. One has six branches of unequal length, giving the appearance of a three-sided snowflake. Another snowflake has only four branches. Apparently, two of its branches didn't grow. Odd variations like these are **typical**. Because different conditions of humidity, wind, and temperature affected the growth of each snowflake as it fell, each design holds secrets of its unique journey to earth.

When a snowflake melts, its intricate design is lost forever in a drop of water. But a snowflake can vanish in another way. It can change directly from ice to vapor. The sequence below shows a single snowflake as it gradually disappears.

Snowflakes, actual size

FROST AND DEW

On some days, when the air is humid, a sudden drop in temperature during the night will cause water vapor to condense on cold surfaces. By morning, the landscape is covered in sparkling drops of water—dew. If temperatures fall below freezing, the cold-weather relative of dew appears—frost.

On windows, frost forms along tiny scratches and other imperfections in the glass. As with snowflakes, frost is the result of water vapor changing from a gas to a solid. That's why the angular structure of ice crystals is evident in the fern-like patterns of frost.

When dew forms, a short walk through the grass will soak your feet. On spider webs, dewdrops appear like glistening pearls. In the photograph above, we can see how water reflects and bends light; an upside-down landscape appears in each drop of water.

STOP AND CHECK

Ask and Answer Questions
How does frost form? Go back to the text to find the answer.

WATER AND LIGHT

If you look carefully at this beam of light, you'll see the mysterious way in which light interacts with water.

Some of the light is reflected, which means that it bounces off the surface of the water. But some of the light passes into the water. As the light enters the water, molecules bend the light, or *refract* it. The bent rays of white light are transformed into all the colors of the rainbow.

How is this possible? White light is made up of waves of many different sizes, or *wavelengths*. The shortest wavelength, which we see as violet, bends the most. Red, the longest wavelength, bends the least. All the other colors fall in between.

Sun shining on spray from a garden hose creates a rainbow. The spray produces drops of water that bend the light and flash bright colors when seen from the correct angle. Natural rainbows work exactly the same way. The sun must be behind you and low in the sky. The arc of the rainbow is caused by the sun shining on billions of spherical raindrops that fill the sky.

THE WATER CYCLE

The sun's heat and the earth's gravity keep water in constant motion. Water evaporates from puddles, ponds, lakes, and oceans; from plants and trees; and even from your skin. Water vapor moves invisibly through the air, but it is always ready to condense on a cool blade of grass or the surface of a pond. Massive clouds form as vapor condenses on tiny particles of dust in the air. Then, and only then, can water fall from the sky as rain, replenishing lakes, rivers, and oceans. Hard to predict, impossible to control, water cycles around the earth.

And water is precious. Without it, not a single living thing could survive. No plants would grow, not even one blade of grass. No animals would roam the earth, not even a spider. But somewhere in the world right now, snow drifts on a mountaintop and rain falls in a valley. And all around us, we are reminded of the never ending journey of a drop of water.

Photo courtesy of NASA

About Walter Wick

Walter Wick is a children's author and photographer. He is best known for the I Spy book series, which he created with author Jean Marzollo.

Walter says he tries to "make the experience of looking at my creations as exciting to others as it is to me." As a result, his photos usually end up fresh and different. Walter spends a lot of time setting up photos that have many parts. His very detailed photos serve to introduce kids to complicated things, such as water molecules!

The photos in Walter's science books explain topics in unexpected, unusual ways. Most readers would agree that in Walter's books, the photos matter at least as much as the words.

AUTHOR'S PURPOSE

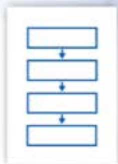
How do Walter Wick's highly technical photos help you understand difficult concepts?

Walter Wick

Respond to the Text

Summarize

Use the most important details from *A Drop of Water* to summarize the selection. Information from your Sequence Chart may help you.



Write

Why does the author begin and end the selection with a drop of water? Use these sentence frames to organize your text evidence:

The author begins the selection . . .
I read that the drop of water . . .
At the end of the selection he says . . .

Make Connections

What are some of the various ways that water molecules can change? **ESSENTIAL QUESTION**

How can viewing things up close change the way people think about the world? **TEXT TO WORLD**

Practice Book Pages

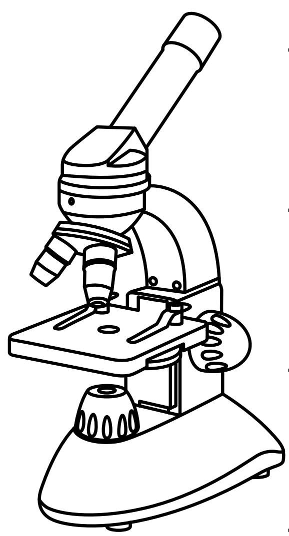
Vocabulary

Name ______________________________

Content words are used to write about fields of study. In this unit, you will find content words related to science and technology, such as *electron microscope, magnification,* and *photomicrograph.* Use context clues, dictionaries, electronic resources, and your knowledge of Greek and Latin roots to help you understand the meanings of these words.

Search classroom texts, newspapers, and magazines for content words related to the tools scientists use. Write the words below.

Science and Technology Words



CONNECT TO CONTENT

"Your World Up Close" describes the technology used to magnify objects, such as snowflakes, fingerprints, and skin cells, to thousands of times their actual size. It also explains how scientists use these magnified images. The author uses content words to tell about these topics.

Circle two words that you were able to define by using context clues. Write the words and their meanings on the lines.

Name ________________________________

Write the vocabulary word from the box that answers each riddle below.

attain	**commitment**	**hovering**	**connotation**
gleaming	**democracy**	**triumph**	**denotation**
dangling	**technology**	**stanza**	**repetition**

1. You'll find me in a dictionary. ____________________

2. I'm felt by the winning team. ____________________

3. I'm a government for and by the people. ____________________

4. I'm a paragraph in a poem. ____________________

5. I'm done over and over again. ____________________

6. I describe a hummingbird in the air. ____________________

7. I'm a promise you make. ____________________

8. I describe how a word makes you feel. ____________________

9. I'm a new kind of phone. ____________________

10. I'm something you hope to do with a goal. ____________________

11. I describe polished silver or gold. ____________________

12. I'm what an acrobat does high above. ____________________

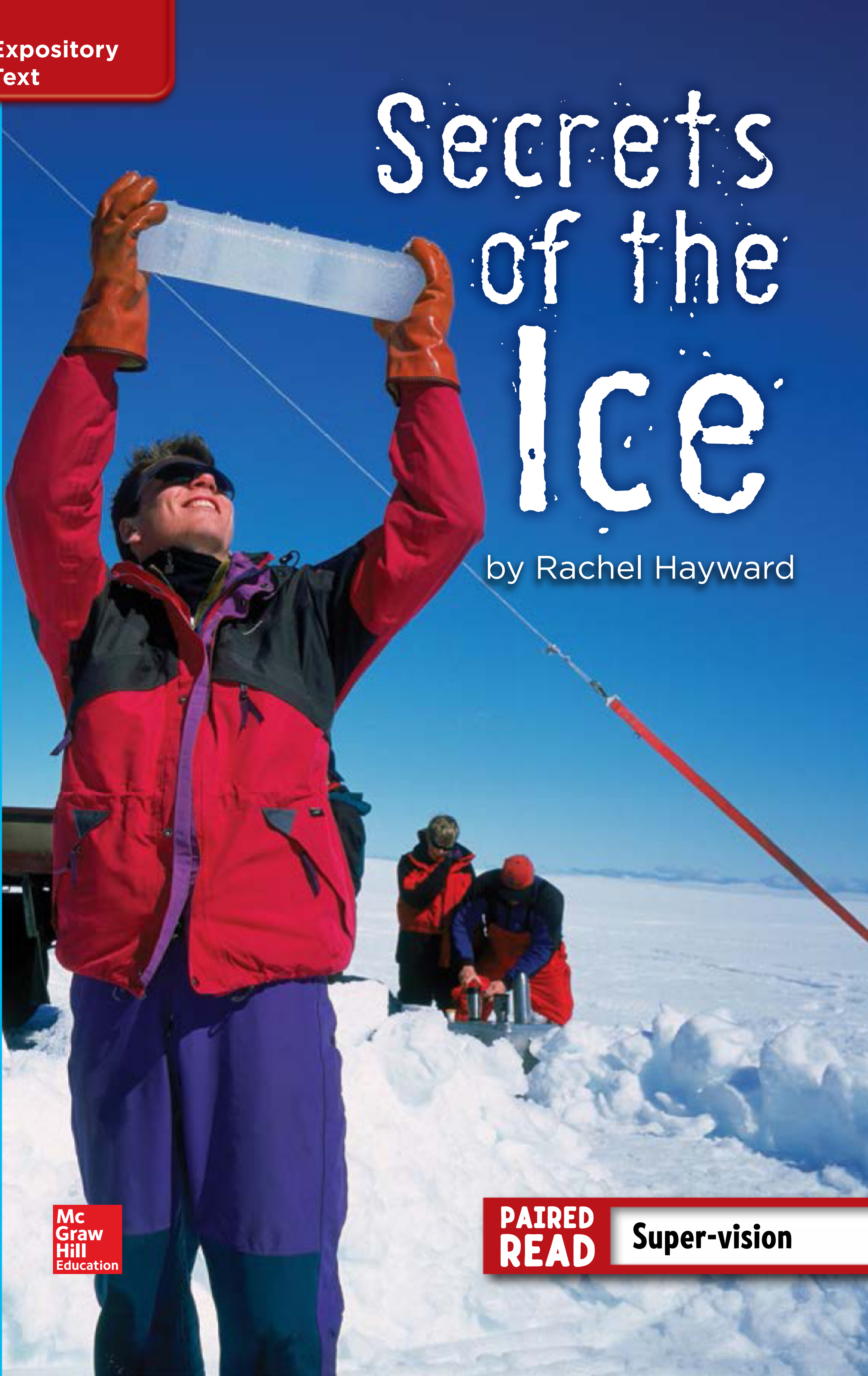
Leveled Reader

On Level

Expository Text

Secrets of the Ice

by Rachel Hayward



PAIRED READ Super-vision

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STRATEGIES & SKILLS

Comprehension

Strategy: Summarize

Skill: Sequence

Vocabulary

clings, dissolve, gritty, humid, magnify, microscope, mingle, typical

Content Standards

Science

Physical Science

Word Count: 1,342**

Photography Credit: Ragnar Th Sigurdsson/Alamy Stock Photo

**The total word count is based on words in the running text and headings only. Numerals and words in captions, labels, diagrams, charts, and sidebars are not included.

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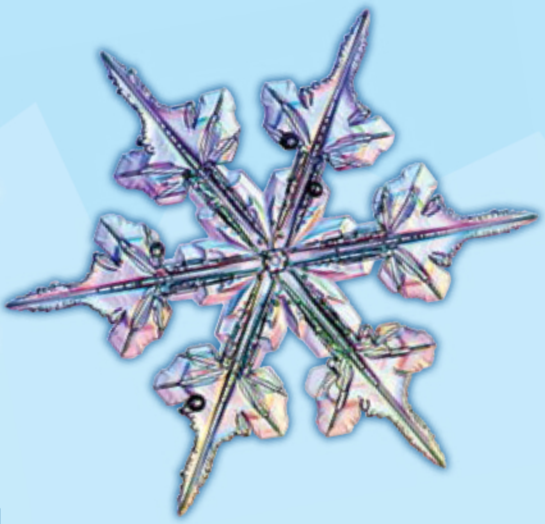
Genre Expository Text

Essential Question

What can you discover when you look closely at something?

Secrets of the Ice



by Rachel Hayward

Kenneth G. Libbrecht

CHAPTER 1

The Properties of Water

What is clear, wet, and runs out of a faucet? What is cold, hard, and floats in your glass? What is invisible and hangs around in the air?

The answer is water. The three **states** of water are water, ice, and **water vapor** or steam. You can find water in a river, ice on a mountain, and water vapor in the air.

Water is the only substance that naturally occurs on Earth as a liquid, a solid, and a gas.

Water has other special qualities. When it is a liquid, substances dissolve in it easily. Salt, sugar, and gases, such as oxygen and carbon dioxide, all dissolve in water.

When water cools to 32 degrees Fahrenheit, it freezes and becomes ice. Most substances shrink when they freeze, but water expands. If you freeze a glass bottle full of water, the water expands and the bottle cracks.

When water occurs as a gas or vapor, it is usually invisible. Air that has a lot of water vapor feels humid and sticky.

Water is always moving around Earth, changing from one state to another. This is called the water cycle.

The sun provides energy for the water cycle. When heated, water changes from a liquid into a gas. This is called **evaporation**. When the sun heats the water in lakes, rivers, and oceans, some of it turns into water vapor. The vapor rises into the **atmosphere**.

As the vapor rises, it cools and changes back into a liquid. This is called **condensation**. Tiny water droplets are formed, which make up clouds and mist.

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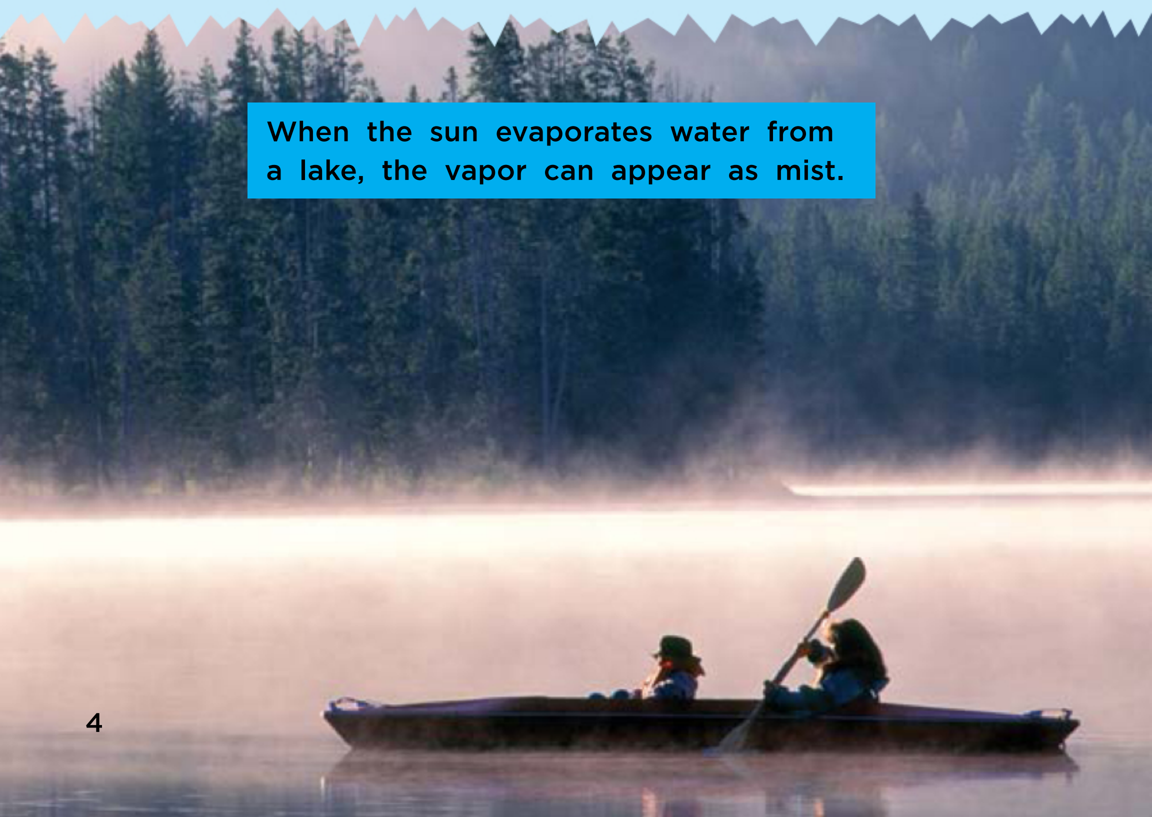


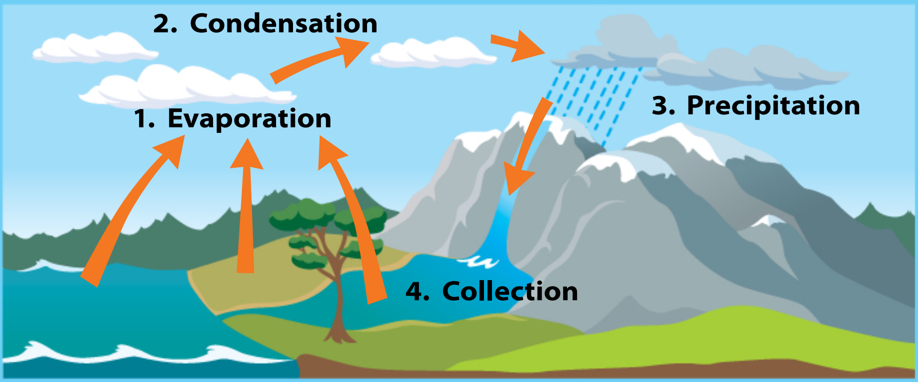
When the sun evaporates water from a lake, the vapor can appear as mist.

When the droplets of water join together in a cloud, they become heavy. They eventually fall back to Earth as **precipitation** such as rain, hail, sleet, or snow.

The water that returns to Earth collects in streams, rivers, or in the ground. Then it's heated by the sun, and the cycle begins again.

As water moves around, it picks up other substances from the environment. When it changes from a liquid into ice or vapor, the other substances that are in the water remain. If we look closely at what the water picked up, we can get information about our planet.

The Water Cycle



1. Evaporation—Water is heated by the sun and turns into vapor.

2. Condensation—The vapor cools and turns back into a liquid.

3. Precipitation—The liquid falls back to Earth as rain, hail, sleet, or snow.

4. Collection—Water collects in streams, rivers, or on the ground.

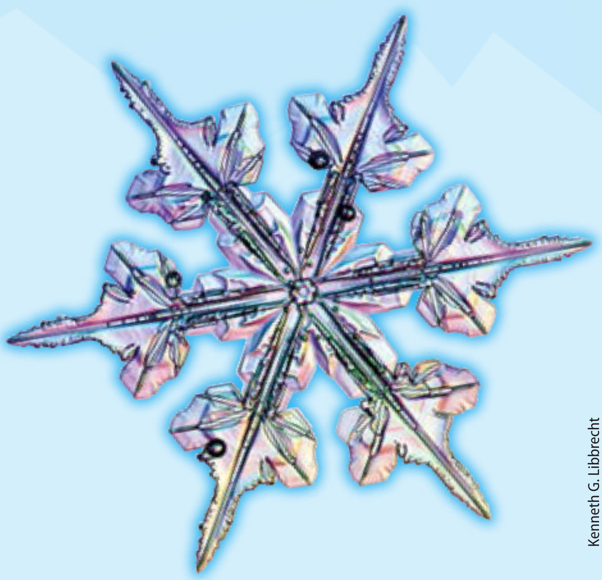
CHAPTER 2

Snow and Ice

Snow forms when water vapor condenses into droplets and the air is very cold. The cold air freezes each droplet into an ice crystal. The crystal grows and sticks to other ice crystals. When a group of crystals becomes heavy enough, it falls to Earth as a snowflake.

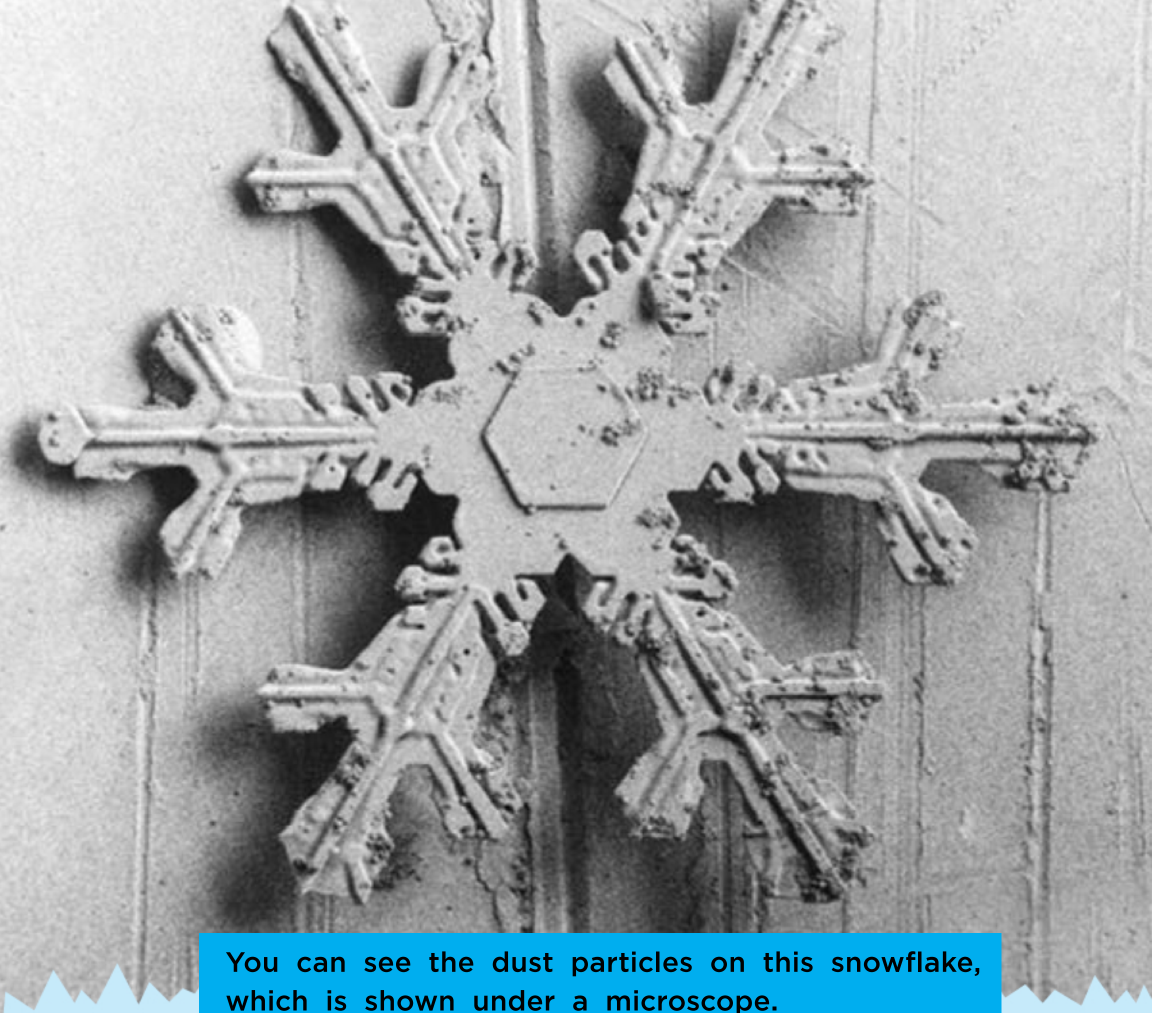
Ice crystals grow in many different shapes. If it's very cold (around 5 degrees Fahrenheit), the crystals usually have a simple shape. If the temperature is not as cold (around 15 degrees Fahrenheit), the crystals are larger and have a more complicated shape.

Dust may mingle with the water. This also changes the size and shape of an ice crystal.



Kenneth G. Libbrecht

This image of a snow crystal was taken with a special microscope.



You can see the dust particles on this snowflake, which is shown under a microscope.

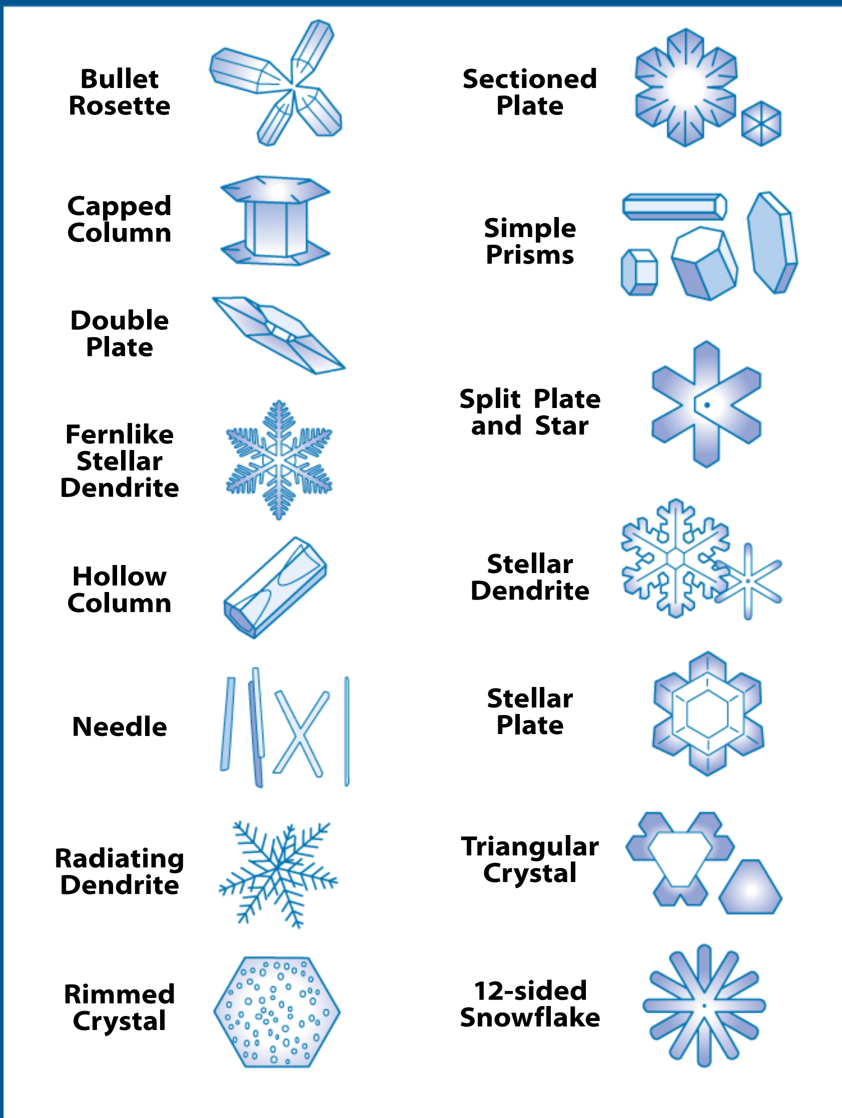
Ice crystals contain a lot of information about their surroundings. This happens because water vapor clings to small **particles** in the air, such as dust or ash. When the vapor changes into liquid and then into ice, those particles are frozen into the ice crystals.

Falling snow can also catch tiny bubbles of air. Each bubble contains gases such as oxygen and carbon dioxide. The bubbles and particles are buried with the snow.

Scott Camazine/Alamy

Looking Closely at Snowflakes

You can examine snowflakes closely using a magnifying glass or a microscope. Most ice crystals have six sides. A snowflake can be made of up to 100 ice crystals.



Snow and ice cover around 80 percent of Greenland.

Imagine if it snowed for thousands of years. Each new layer of snow would press down on the older snow. The snow, and any dust, ash, or air bubbles, would be **compacted** as ice.

This is how ice built up in the polar regions. Scientists aren't sure how old the ice is in places such as Antarctica and Greenland, but they think it's at least hundreds of thousands of years old. Ancient dust, ash, and gases are buried in the ice, too.

CHAPTER 3

Looking Closely at Ice

Scientists are able to learn what Earth's climate and atmosphere were like in the past by studying the ancient ice in the polar regions.

First, they extract a column of ice called an ice core. They use a special hollow drill with sharp teeth that spin and cut through the ice. As it moves down, the hollow part of the drill fills up with ice. If you twist and push a hollow tube into soft snow, a column of snow fills the inside of the tube. The drill works in the same way.

The Best Place to Drill

Scientists look for a place where the ice hasn't melted or moved much over time. It also needs to be a place where there are no crevasses, or deep cracks. The scientists use radar to find out how deep the ice is and whether there are many layers beneath the surface.

This drill is used to extract ice cores.

David Hay Jones/Science Source

The ice core is removed in sections. After one section is extracted, the drill is put into the same hole and it brings up a section of older ice.

A typical section of ice is between 2 feet and 10 feet long. However, the full ice core could be 300 feet long. This means the scientists drilled 300 feet down into the ice! An ice core may be extracted from 2 miles down in polar regions where the ice is very thick.

This scientist is holding a section of ice core.

Ragnar Th Sigurdsson/Alamy Stock Photo

After the ice cores have been extracted, the sections are taken to a laboratory.

Scientists carefully **analyze** the sections of ice core. They use powerful microscopes to magnify the tiny particles in the ice. Ash and gases in the ice core might show that a volcano erupted about the time the ice layer formed. Traces of salt in the ice core might mean there were strong winds blowing in from the ocean when the ice formed.

When a section of ice core is placed over a strong light, it's easier to see the layers in the ice.

Anthony Gow/United States Army Corps of Engineers, Cold Regions Research and Engineering Laboratory/NOAA

Scientists can study the oxygen trapped in the air bubbles in the ice to figure out the temperature at the time the ice formed.

Scientists also test the ice for gases such as carbon dioxide and methane. These are called "greenhouse gases" because they trap the sun's heat inside Earth's atmosphere.

Knowing the amount of greenhouse gases in the atmosphere also helps scientists figure out what the temperatures were like.

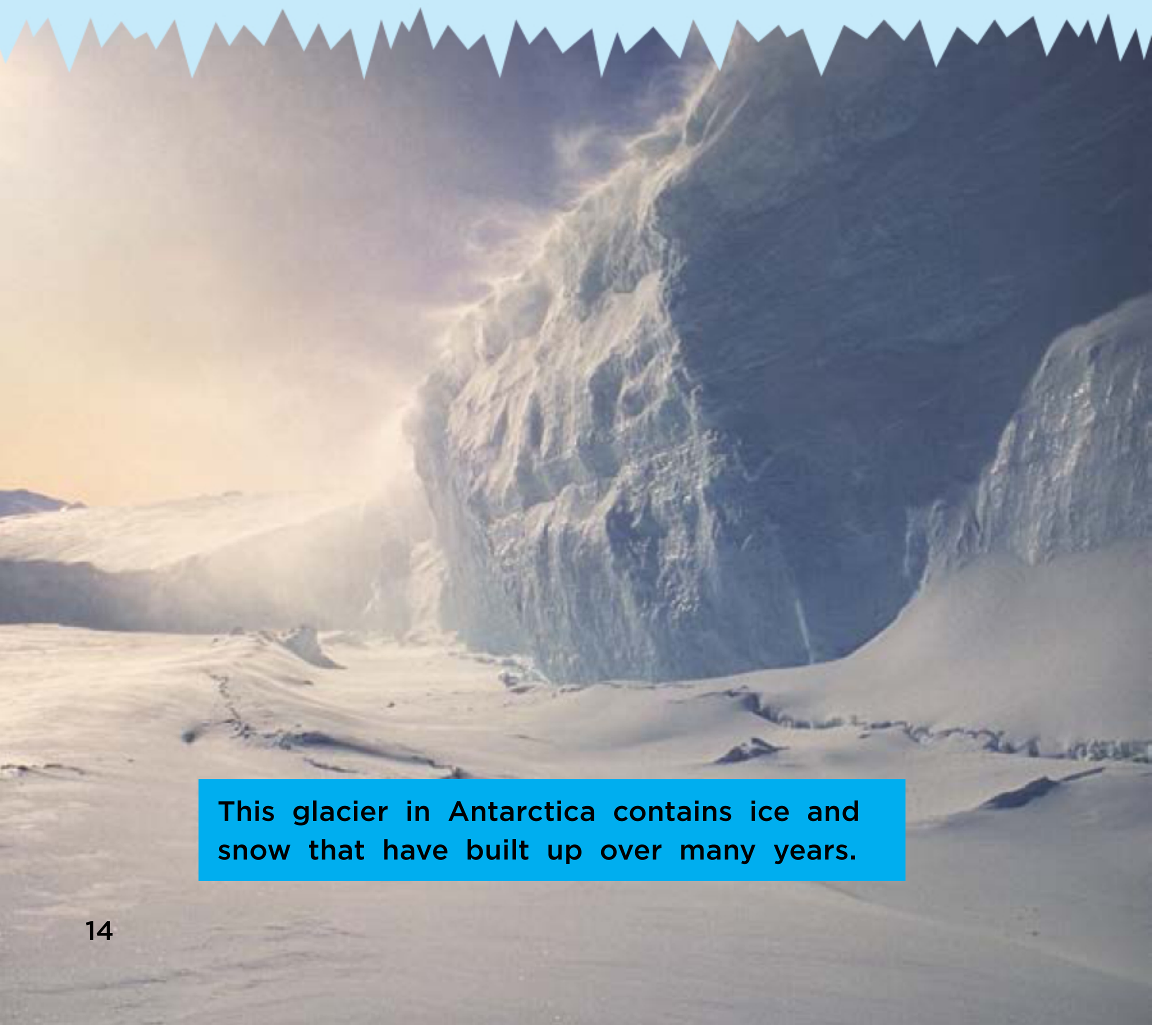
Karim Agabi/Science Source

This scientist is taking a closer look at the ice core.

The information in the layers of crystals buried in ice cores tells us how the climate has changed. This can help scientists predict how Earth's climate might change again.

As a solid, liquid, or gas, water captures important information about the world around us. Who would have thought that ancient ice could hold so many secrets? It's amazing what we can learn when we know where to look and when we look closely.

Gerald Kooyman/CORBIS

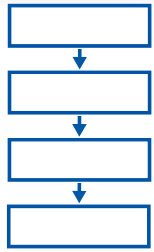


This glacier in Antarctica contains ice and snow that have built up over many years.

Respond to Reading

Summarize

Use the most important details from *Secrets of the Ice* to summarize the selection. Your graphic organizer may help.



Text Evidence

1. Look at page 10. What features on this page help you identify the kind of text *Secrets of the Ice* is? **GENRE**

2. Look at the diagram on page 5. How does it explain how the water cycle works? **SEQUENCE**

3. What does the word *expand* mean on page 3? Use context clues to figure out its meaning and to find an antonym on the same page. **ANTONYMS**

4. Write about how information gets buried in the ice. What happens first, next, last? Include details from the text in your answer. **WRITE ABOUT READING**

Genre Fantasy

Compare Texts

Read about a girl who discovers that she can see things up close.

SUPER-VISION

Mia sighed heavily. All her friends were on vacation, and she was bored.

"Cheer up!" said Mom. She wiped an eyelash off Mia's cheek. "Blow this and make a wish—that's what my grandmother used to say."

Mia blew the eyelash into the air, wishing hard. "Let me see something NEW today!"

She opened her eyes. Her brother, Ben, had spilled both salt and sugar on the table. As she looked at the gritty white crystals, Mia realized that the harder she stared, the bigger the crystals became. She saw they were different. The salt crystals were cubes, while the sugar crystals were hexagonal.

Mia blinked hard, and the crystals were tiny again. She tried staring again. Things magnified when she focused and returned to normal when she blinked.

"Mom," she said, "I have microscopic vision."

"That's nice," her mother replied absentmindedly.

Microscopic vision made ordinary things extraordinary. Mia examined the details of tiny pores and hair follicles on her arm.

"Earth to Mia!" called Mom. "Can you take the trash out, please?"

The front yard was a journey of discovery—spiderwebs, leaves, and specks of dirt. Mia saw the world with new eyes.

She lifted the lid of the trash can and shrieked. It was like a scene from a horror movie! Rotten apples, blackened banana peels, moldy crusts … Mia turned away and ran back to the house.

Illustration: Scott Pearson

Later, Mom and Ben were in the yard. Mia's eyes zoomed in on some ugly monsters marching toward Ben's foot! She gasped.

"Mia! What's wrong?" asked Mom.

Mia blinked, and the monsters turned into ants.

Mia caught an eyelash from Ben's cheek, closed her eyes, and blew it into the air. "Please give me back my boring eyesight!" she wished.

She opened her eyes and focused on Ben's hair. Nothing. She kissed Ben's normal-sized cheek.

"You're in a better mood," said Mom.

"Let's say I'm seeing things in a whole new light!" said Mia, grinning.

Illustration: Scott Pearson

Make Connections

What does Mia discover about the world with her microscopic vision? **ESSENTIAL QUESTION**

How are the scientists in *Secrets of the Ice* similar to Mia in *Super-vision*? **TEXT TO TEXT**

Glossary

analyze *(AN-uh-lighz)* study or examine something closely ***(page 12)***

atmosphere *(AT-muh-sfeer)* the layer of gases that surround Earth ***(page 4)***

compacted *(kom-PAK-tuhd)* pressed together to become harder and take up less space ***(page 9)***

condensation *(kon-den-SAY-shuhn)* the process of a gas cooling and becoming a liquid ***(page 4)***

evaporation *(ee-va-puh-RAY-shuhn)* the process of water heating and becoming a gas ***(page 4)***

particles *(PAHR-ti-kuhlz)* tiny pieces ***(page 7)***

precipitation *(pree-si-puh-TAY-shuhn)* rain, hail, sleet, or snow that falls to Earth ***(page 5)***

states *(stayts)* forms or conditions of being ***(page 2)***

water vapor *(WAW-tur VAY-pur)* water that has become a gas ***(page 2)***

Index

Focus on

Science

Purpose To create a mini water cycle

Procedure

You will need a large bowl, some plastic wrap, a glass that is shorter than the bowl, water, and several coins.

Step 1 Pour the water into the bowl until it is about a quarter full.

Step 2 Put the glass in the center of the bowl.

Step 3 Cover the bowl tightly with plastic wrap. Set several coins in the center of the plastic so they are above the glass.

Step 4 Put the bowl on a sunny windowsill for a few days.

Conclusion What happened? Is the water level in the bowl the same? What changed with the glass? Why? The principles of the water cycle work in a mini cycle that you can make as well as in the natural world around us.

Literature Circles

Nonfiction

Thinkmark

The Topic

What is *Secrets of the Ice* mostly about?

Text Structure

How does the author organize information in *Secrets of the Ice*?

What process does the author explain first?

How does that help you understand the scientists' work?

Vocabulary

What new words did you learn in the text?

What helped you understand what they mean?

Author's Purpose

Why do you think the author wrote *Secrets of the Ice*?

Conclusions

What is the most important thing you learned in *Secrets of the Ice*?

Zoom In | Science

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