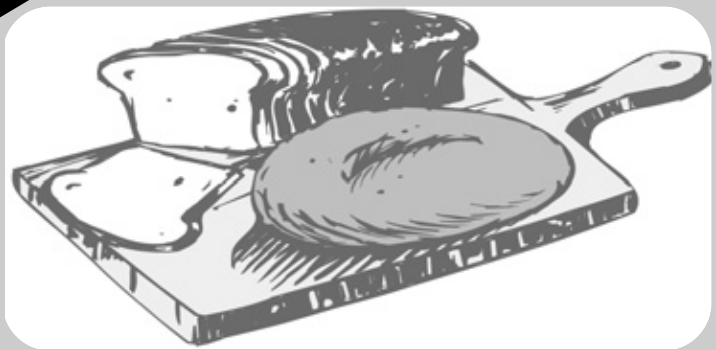
Physical Sciences

FOCUS ON OHIO STANDARDS

Chemical and Physical Changes

On Level



Physical Sciences
Benchmark A, Grade-Level Indicators 2, 3, 4

Scientific Inquiry
Benchmark A, Grade-Level Indicator 2

Scientific Ways of Knowing
Benchmark A, Grade-Level Indicator 3

English Language Arts
Acquisition of Vocabulary 1, 4, 6
Reading Processes 2, 4, 5, 6
Reading Application 3, 5, 8

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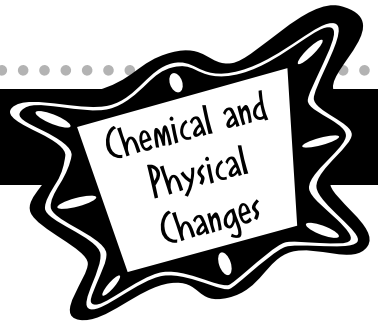


Grade 6: Science

Physical Sciences

Benchmark A: Relate uses, properties, and chemical processes to the behavior and/or arrangement of the small particles that compose matter.

Grade-Level Indicator 2: Describe that in a chemical change new substances are formed with different properties than the original substance (e.g., rusting, burning).

Grade-Level Indicator 3: Describe that in a physical change (e.g., state, shape, and size) the chemical properties of a substance remain unchanged.

Grade-Level Indicator 4: Describe that chemical and physical changes occur all around us (e.g., in the human body, cooking and industry).

Scientific Inquiry

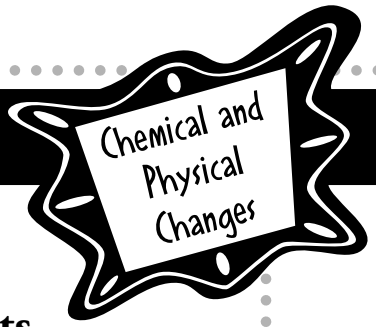
Benchmark A: Explain that there are differing sets of procedures for guiding scientific investigations and procedures are determined by the nature of the investigation, safety considerations, and appropriate tools.

Grade-Level Indicator 2: Choose the appropriate tools or instruments and use relevant safety procedures to complete scientific investigations.

Scientific Ways of Knowing

Benchmark A: Use skills of scientific inquiry processes (e.g., hypothesis, record keeping, description, and explanation.)

Grade-Level Indicator 3: Identify ways scientific thinking is helpful in a variety of everyday settings.



Grade 6: English Language Arts

Acquisition of Vocabulary

Grade Level Indicator 1: Define the meaning of unknown words by using context clues and the author's use of definition, restatement, and example.

Grade Level Indicator 4: Interpret metaphors and similes to understand new uses of words and phrases in text.

Grade Level Indicator 6: Apply the knowledge of prefixes, suffixes, and roots and their various inflections to analyze the meanings of words.

Reading Process

Grade Level Indicator 2: Predict or hypothesize as appropriate from information in the text, substantiating with specific references to textual examples that may be in widely separated sections of text.

Grade Level Indicator 4: Summarize the information in texts, recognizing important ideas and supporting details, and noting gaps or contradictions.

Grade Level Indicator 5: Select, create and use graphic organizers to interpret textual information.

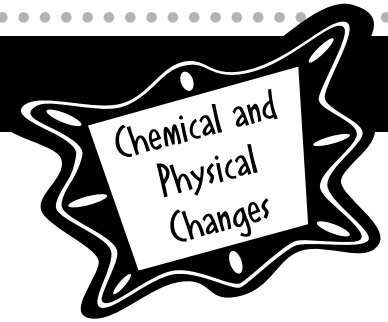
Grade Level Indicator 6: Answer literal, inferential, evaluative, and synthesizing questions to demonstrate comprehension of grade-appropriate print texts, electronic and visual media.

Reading Application

Grade Level Indicator 3: Compare and contrast important details about a topic, using different sources of information including books, magazines, newspapers and online resources.

Grade Level Indicator 5: Analyze information found in maps, charts, tables, graphs, diagrams, and cutaways.

Grade Level Indicator 8: Summarize information from informational text, identifying the treatment, scope and organization of ideas.



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How to Help Your Students Make the Best Use of This Book

Encourage students to develop nonfiction literacy skills by completing the Active Reader activities. Also encourage them to . . .

- Underline main ideas in paragraphs.
- Circle details that support the main ideas.
- Write down questions as they read.
- Circle key words as well as unfamiliar words.

Printing Instructions

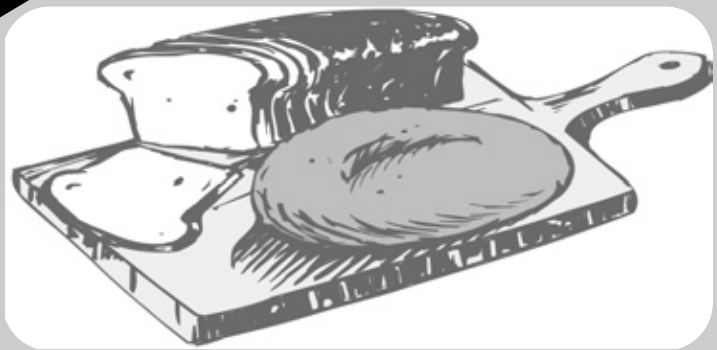
Student Book: print pages 5–29

Assessments: print pages 31–32

Answer Key: print pages 33–35

FOCUS ON OHIO STANDARDS

Chemical and Physical Changes



Change happens all the time. Scientists classify changes into two categories: chemical and physical. Physical changes are changes in state, shape, or size. For example, slicing bread is a physical change. The bread is still bread. It's just sliced.

Chemical changes alter the chemical properties of the substance. For example, toasting bread is a chemical change. The bread is no longer soft and white. It is crunchy and burnt. It is no longer bread because you cannot make is soft and white again.

This book will explain and provide you with more examples of chemical and physical change.

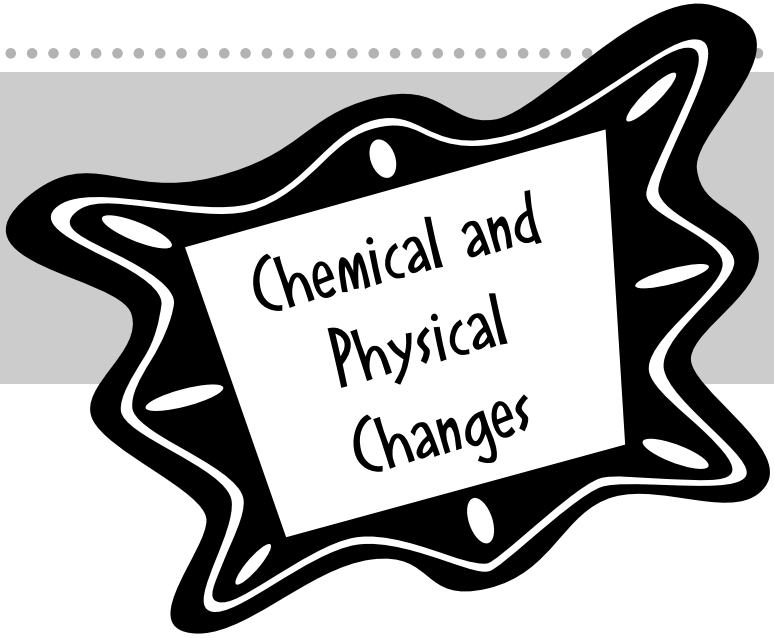


Table of Contents

Build Background

Recall

Water can take three different forms, or states, depending on its temperature. What are the three states of water? The first one is done for you. Then write a word to tell about each state of water.

1. Solid: _____ 2. _____: _____

3. _____: _____

Predict

If you put vinegar and baking soda together, a chemical change occurs. What might you see if you put vinegar and baking soda together? Write a sentence or two predicting what might happen.

_____

_____

Label It

Here are three groups of words that have do to with the three states of matter. Add a word or two to each list.

①	
rock	
plastic	
icicle	

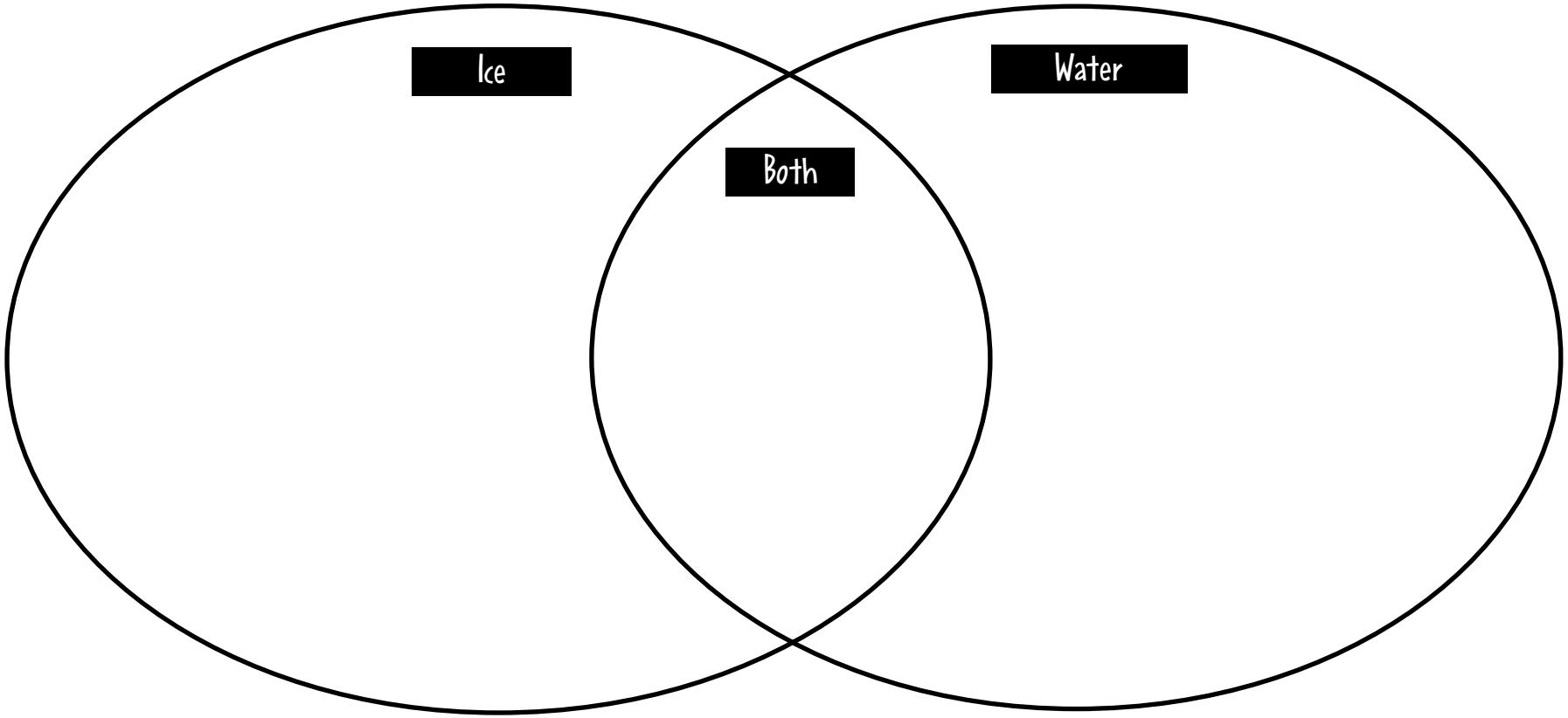
②	**Liquid**
juice	
lava	
shampoo	

③	
oxygen	
helium	
air	

Investigate States of Matter

Ice and liquid water are two different states of matter. Ice is a solid. Water is a liquid. But, both are still just made up of water. In this activity, you will explore how water and ice are the same and different. Record your observations in the Venn diagram.

1. **Fill one glass with water and one with ice.**
2. **Measure the temperature in each glass or touch the outside of each glass. Are the temperatures alike or different?**
3. **Smell the ice. Smell the water. Do they smell alike or different?**
4. **Look for any other differences and similarities between ice and water. Write them in the Venn diagram below.**



Starting Points

Key Vocabulary

Rate Your Knowledge

The words listed below have to do with change. Each word is important to know, but some of them may be new to you. Rate your knowledge of each one by putting a check or a few words in the appropriate column.

	I don't know it.	I've seen it, but I'm not sure what it means.	I know it well. It means...
physical changes			
chemistry			
chemical changes			
molecules			
oxidation			

Use Roots to Unlock Meaning

Knowing roots can help you unlock the meanings of many science terms. Read the root and the suffix below. Write a word that contains the root and the suffix. Then figure out the meaning.

chem (meaning "relating to the interaction of substances") plus ***ist*** (meaning "a person who practices or studies something")

word: _____

possible meaning: _____

Interpret Metaphors

Have you heard the phrase "solid as a rock"? This means that something or someone is not likely to change. Then consider, what if someone said "solid as ice"? Would this have the same meaning? Why or why not? Think of another metaphor about matter. Write it below.

_____

_____

Starting Points

Key Concepts

Physical and Chemical Changes

Objects can change in two ways—physically or chemically. A physical change occurs when the appearance of a substance changes. In other words, physical changes are changes in size, shape, or state. Sharpening a pencil is a physical change because the pencil because the pencil is still made up of the same materials. It just gets sharper.

A chemical change creates a new substance. Sometimes it even creates several new substances. A chemical change can create heat, bubbling, or a color change. For example, an old nail that has gotten wet turns orange. That's the color of a new substance—rust.

ACTIVE READER

1 Monitor *Underline the sentence that gives the definition of physical change. Circle the sentence that gives the definition of chemical change.*

Is the Change Chemical or Physical?	
1. boiling water	
2. rusting metal	
3. sharpening a pencil	
4. chewing food	
5. wearing out running shoes	

Good to Know

All chemical changes involve changes in energy. Some chemical changes take in energy. These types of changes lower the temperature of the substances. Other types of chemical changes give off energy. These types of changes make the substances warmer. Energy is given off when an iron nail rusts. This energy will make the nail a little bit warmer. Burning logs give off a lot of energy.

Chapter 1 Physical Changes

FOCUS

The underlined sentences state important ideas about physical changes. As you read, find out about different types of physical changes and find examples of physical change in everyday life.

Changes are always happening. Some are physical changes. Some are chemical changes. My Uncle Edward knows a lot about chemical and physical changes because he's a high school **chemistry** teacher. He taught me a lot about science through his favorite hobby: cooking!

The kitchen is a great place to study physical changes. There are three main types of **physical changes**: changes in size, changes in shape, and changes in state. When an object is changed physically it is still made of the same material and has the same basic characteristics. For example, a cookie is still a cookie whether it is whole or broken into pieces.

Changes in Size

While you are thinking about food, think about making a salad. You cannot eat a huge head of lettuce in one bite. Instead, you have to tear the lettuce into small pieces. This is a physical change. The lettuce is still yummy, crisp, and leafy. But it is physically changed into nice bite-size pieces.

Tearing lettuce does not change the lettuce chemically. Lettuce, like almost everything else in the world, is made up of **molecules**. Tearing lettuce with your hands does not change those molecules into new types of molecules. It does not change into something new. So, you can see that when you tear lettuce, the change is physical.

Other vegetables that go into a salad undergo physical changes, too. Not all these changes can be made by tearing. My uncle and I use a paring knife to peel carrots. Then, we slice the carrots into smaller pieces. These are also physical changes.

ACTIVE READER

1 List *What are the three types of physical changes?*

a. _____

_____

b. _____

_____

c. _____

_____

2 Analyze *What is the main idea of the 4th paragraph? List one supporting detail.*

_____

_____

_____

_____

_____

_____

_____

Changes in Shape

A physical change can also describe a change in shape. Think about that salad again. I like tomatoes in my salad, but I don't put a whole tomato on top. I have to chop or slice it. A tomato can change shape in several ways. For example, my uncle likes very thin round slices. I like to cut tomatoes into wedges. Both of these changes are physical changes.

We argue about which shape is easiest to eat. But we can't argue about what the different shapes are made of. They are still just tomato. Even though the shape is different, the tomato is the same.

Liquids also change shape. In fact, all liquids take the shape of their container. Think about pouring salad dressing on that salad. The dressing doesn't stay bottle-shaped! Instead, the dressing spreads out across the salad. Every time a liquid changes shape, it is a physical change.

FOCUS QUESTIONS

1. **What are the two types of physical changes you read about in this section?**

2. **What is an example of a physical change that you see every day?**

ACTIVE READER

1 Consider *What is one way to change the shape of a tomato?*

2 Compare and Contrast *Think about what you read about tomatoes. How are slices and wedges of tomatoes alike? How are they different?*

Good to Know

A molecule is the smallest part of a substance that is still made of the same material. It is only possible to view molecules with the help of special tools.

FOCUS

The next section explains changes in state. As you read, remember that changes in state are physical, not chemical, changes.

Changes in State

Remember, there are three main states of matter: solid, liquid, and gas. To change matter from a solid to a liquid to a gas you need to use heat. To change matter from a gas to a liquid to a solid, you take the heat away or you freeze the substance.

Uncle Edward makes wonderful frozen fruit juice pops. First, he pours fruit juice into an ice cube tray. Then he puts small wooded sticks into each cube. He puts the liquid juice in the freezer. After a few hours, the juice turns into a solid. The frozen juice is still fruit juice, except now it is frozen. This is a physical change in state because we started with a liquid and now have a solid. We pop the frozen juice out of the ice cube tray and enjoy a frozen treat.

One way to test whether or not a substance has changed state is to add or remove heat and see if the substance changes. For example, what happens if you leave the frozen juice sitting out on the kitchen table? The warm air temperature causes the solid to melt back into a liquid. It has the same properties as before it was frozen. It is still fruit juice. Freezing it was a physical change, not a chemical change.

What would happen if you left ice cream outside on a hot day? Would the ingredients still be the same?

ACTIVE READER

1 Summarize *What do you need in order to change a solid to a liquid?*

_____

_____

_____

2 Hypothesize *What would happen if you put melted ice cream in a hot oven?*

_____

_____

_____

Good to Know

Have you ever left a can of soda in the freezer? The soda pushes out on the can. The water in the soda expands, or get bigger, when it freezes. So, never freeze water in a glass container—it could break as it expands.

Melting Versus Burning

To make chocolate chip cookies you first need to melt butter. Then it is easier to stir sugar, a solid, into the butter when the butter has been melted into a liquid.

The first time we made the recipe, I heated the butter for too long. I burned the butter instead of melting it. The butter turned from a yellow liquid to a smelly, dark brown mess. This was a chemical change.

My uncle explained the **phenomenon**. When you first apply heat to a solid substance like butter, it melts into a liquid. This is a physical change. You can prove that this is a physical change because if you put the melted butter back in the fridge, it changes back to solid butter.

However too much, or **excessive**, heat can cause a chemical change in some things. If the heat is too high or applied for too long, the solid may burn. Burning can cause changes in color or smell. It also makes butter taste bad. How can you prove that the butter has had a chemical change? Even when you take the heat away, it will never change back into a yellow, tasty solid.

ACTIVE READER

1 Summarize *How can you prove that melting is a physical change?*

_____

_____

_____

_____

2 Words in Context *Find the phrase* excessive heat *in the text. What words in the next sentence tell you what* excessive *means in this sentence?*

_____

_____

_____

FOCUS QUESTIONS

1. **How are fruit popsicles and fruit juice alike? How are they different?**

_____

_____

2. **Explain how you know that burning butter is a chemical change.**

_____

_____

Stop and Think

This page will help summarize what you have read so far. The following questions are similar to those that might appear in the Ohio Achievement Assessment in Science about physical changes.

1. **Which is an example of a physical change in size?**

   Ⓐ slicing a loaf of bread
   Ⓑ freezing water into ice
   Ⓒ making vanilla ice cream
   Ⓓ making chocolate chip cookies

2. **Which is an example of a physical change in shape?**

   Ⓐ freezing water into ice
   Ⓑ burning a stick of butter
   Ⓒ making chocolate chip cookies
   Ⓓ pouring juice from a glass to a bowl

3. **Which is an example of a physical change in state?**

   Ⓐ making ice cream
   Ⓑ freezing water into ice
   Ⓒ burning a stick of butter
   Ⓓ making chocolate chip cookies

4. **Adding heat energy can cause a solid to change to a liquid or a gas.**

   Describe what happens when excessive heat is added to a substance such as an egg. Then, explain why this is not a physical change. (2 points)

   Describe: _____

   _____

   _____

   Explain: _____

   _____

   _____

Dear Ms. Understanding,

I'm confused. When my mom makes salad dressing, she puts olive oil, vinegar, and herbs in a bottle. Then, she shakes it up. It's not just oil, vinegar, and herbs anymore. It's salad dressing. Isn't this a chemical change?

Mixed Up in Cleveland

Dear Mixed Up,

Well, we do use a different name, "salad dressing." But, the stuff in your mom's bottle is still just oil, vinegar, and herbs. Try this experiment. Let the bottle sit for about 5 minutes. The oil will sink to the bottom since it is heavier than vinegar. The vinegar will float on top. So, making salad dressing is just a physical change.

Ms. Understanding

Classify Physical Changes Think about what you had for lunch this week. Write examples of the physical changes that took place to create your lunch. Remember that an example might fit in more than one column.

Changes in Size	Changes in Shape	Changes in State

Chapter 2 Chemical Changes

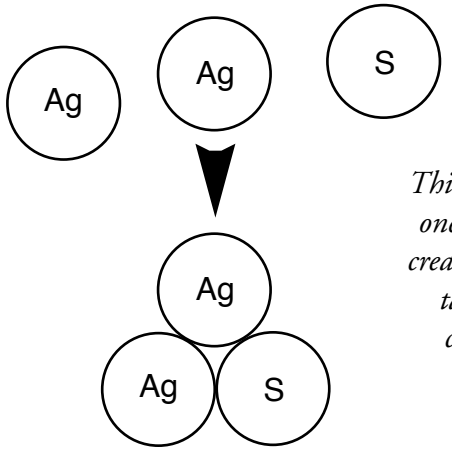
FOCUS The underlined sentence states an important idea about chemical changes. As you read, find out about three examples of chemical changes.

Extreme Changes

Chemical changes are different than physical changes because they create new substances. Chemical changes involve changes in **molecular** structure. They can break apart or join other molecules. A chemical change sometimes causes heat, bubbling, or a color change.

Have you ever had to polish silverware? Polishing silver is necessary because over time it gets covered in a black coating. This black coating is called **tarnish**. The silver (Ag) changes when sulfur (S) in the air touches it. This chemical change creates tarnish, which is also known as tarnish silver sulfide (Ag^2S).

Because this chemical change is taking place on the molecular level, it is invisible to the naked eye.



This diagram shows two silver (Ag) molecules and one sulfur (S) molecule. They can join together to create a silver sulfide molecule. Silver sulfide is the tarnish you see on silverware. This is a chemical change. You can't see any heat or bubbling, but you do see a color change.

ACTIVE READER

1 Infer *Find the word* tarnish *in the text. What words in the previous sentence tell you what* tarnish *means?*

_____

_____

2 Recall *A chemical change may cause what three things?*

_____

_____

_____

Good to Know

Why don't silver coins like nickels, dimes, and quarters tarnish? They don't tarnish because they aren't really made of silver. They are made of other metals that look similar to silver. These metals don't tarnish like silver does.

Rusting

Some chemical reactions are good while others are not. Let's look at one kind of bad chemical change: rust. You have probably seen rust on old nails or cars at a junkyard.

Rust is an orange powder. It forms when particles of iron combine with particles of oxygen in a process called **oxidation**. Rust occurs only when water touches iron, so it is important to dry iron pans well after cooking and washing, or to keep your bike out of the rain.

Rust weakens the surface of the pan. It make the pan look bad. Even worse, rust is brittle and flaky. It can come off in the food.

To keep his cast iron pans from rusting, my uncle rubs them with olive oil. This keeps air and water from getting to the iron and rusting it.

This wagon is rusty. What could you do to prevent rust?

ACTIVE READER

1 Research *What other everyday objects contain iron?*

_____

_____

2 Identify *Underline the sentence that defines* oxidation.

3 Hypothesize *What could you do to keep a bike chain from rusting?*

_____

_____

_____

FOCUS QUESTIONS

1. **Explain the difference between chemical changes and physical changes.**

_____

_____

2. **How does air affect silver? How does it affect iron?**

_____

_____

Web Quest

There are many products for sale that help get rid of rust. What are some of these products? How do they work? Search the Internet using the term *rust removal* to find out.

FOCUS

As you read about burning and baking, find out what is needed to create these chemical changes.

Burning

Did you know that burning is a chemical reactions? **Carbon**, a black, bitter tasting substance, is produced when many substances burn. If you apply high heat to almost anything in a kitchen, it will eventually burn. Have you ever had chocolate chip cookies that were black on the bottom? They turned black because they got too much heat. The cookie dough burned, creating carbon.

How can you tell that burning is really a chemical change? Here's one easy way. Freeze the burned food and see if it goes back to its original state. Unlike melting, burning is **irreversible**. Once something has burned, it has become a new substance. It cannot be changed back.

Did you know that burning requires oxygen? So, if something in a pot catches fire, tell the adult you are cooking with to put the lid on tight. The lid will keep out air, and without oxygen, the fire will go out.

A campfire is an example of a chemical change. The carbon molecules in the wood react with the oxygen in the air, resulting in ash, smoke, light, carbon dioxide, water, and heat.

ACTIVE READER

1 Summarize *What two things are needed in order for something to burn?*

_____

_____

2 Apply *The word* reversible *means "able to be reversed." But adding the prefix* ir- *changes the word to mean "not able to be reversed." Use what you now know to discover the meaning of the word* irreplaceable.

_____

_____

Good to Know

Most fire extinguishers work by smothering the fire. In other words, they remove the fire's oxygen. The extinguisher replaces the oxygen with another gas that doesn't burn easily. In most cases, fire extinguishers spray carbon dioxide because it is cheap and easy to store.

Baking

Many kinds of chemical change happens during baking. Think about how muffins or biscuits are liquid and flat when they go into the oven. Then, they come out looking plump and firm. **Leavening agents** cause the muffins and biscuits to rise. Baking soda and baking powder are both leavening agents.

When baking soda or baking powder is combined with the wet ingredients in dough, then exposed to heat in the oven, a chemical change occurs. This chemical change causes bubbling. The bubbles lift the dough as it bakes.

Baking soda and baking powder cause good chemical changes—if you use the right amount. Adding too much leavening agent will cause the dough to rise higher, but it will have a salty taste. This is because one of the results of the chemical change is the creation of a type of salt.

FOCUS QUESTIONS

1. **How do you know that burning is a more extreme change than melting?**

2. **Explain what happens on a molecular level during a chemical change.**

ACTIVE READER

1 Extend *An* agent *is something used to produce a specific effect. What is the effect of a leavening agent?*

2 Hypothesize *What would happen if you forgot to add a leavening agent when baking biscuits?*

There are many different kinds of leavening agents. Some are used in cooking. Some are used for other purposes. What are some more examples of leavening agents? How do they work? Search the term *leavening agent* to find out.

Stop and Think

This page will help summarize what you have read so far. The following questions are similar to those in the Ohio Achievement Assessment in Science about chemical changes. Use the tip to help you answer the questions.

1. What is one sign of a chemical change?

Ⓐ change in size
Ⓑ change in mass
Ⓒ change in color
Ⓓ change in state

> **Tip:**
> Look back through the text to find a heading related to the question. Reread that section.

2. Carbon is produced by which chemical change?

Ⓐ baking
Ⓑ burning
Ⓒ tarnishing
Ⓓ oxidation

3. Rusting is a chemical change that occurs all around us.
Describe how rust is formed. Then, explain why it is a chemical change. (2 points)

Describe: _____

_____

_____

Explain: _____

_____

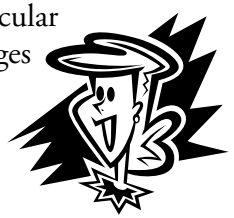
_____

Dear Ms. Understanding,

It seems hard to see chemical changes take place. In the baking soda example, how do I know there's bubbling? I can't see what happens inside the oven.

Skeptical in Sandusky

Dear Skeptical,



I understand your point. It's true that you can only be certain that chemical changes have taken place if you can see molecular changes. But, changes in temperature and color are also good signs that a chemical change has taken place.
In the baking soda example, you could do an experiment to prove that a chemical change has occurred. Bake cookies with and without a leavening agent. I don't think you'll find the unleavened cookies very tasty!

Ms. Understanding

Hands On Science

Develop a Hypothesis

You have just learned that oxygen and water rust iron. Read the following instructions for an experiment and answer the questions that follow. If you have time, try the experiment yourself.

Materials:

Two clean pads of steel wool
Two clear plastic cups
Water
Vegetable oil

Steps:

1. Put each pad of steel wool in the bottom of a plastic cup.
2. Add just enough water to one cup so that some of the steel wool sticks out.
3. Completely cover the other steel wool pad with water. Then, carefully pour a spoonful of vegetable oil over the water in this cup.
4. Leave both cups out overnight.

1. What do you think will happen to the steel wool in the first cup, which is sticking up above the water? Why?

2. What do you think will happen to the steel wool in the second cup, which is covered in both water and vegetable oil? Why?

Chapter 3 Changes All Around

FOCUS

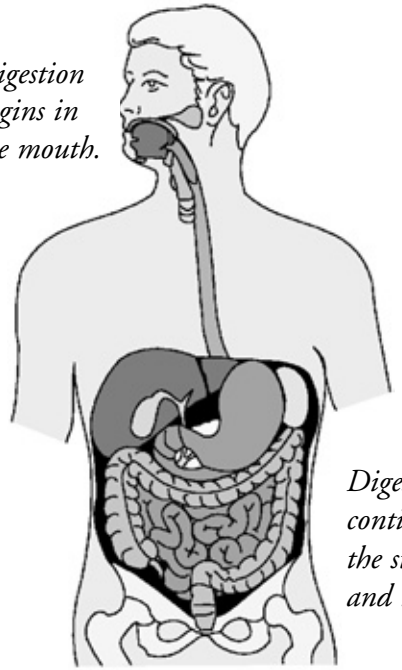
The underlined sentence states an important idea about physical and chemical changes. As you read, find out about two more examples of physical and chemical changes.

The kitchen isn't the only place to study physical and chemical changes. Chemical and physical changes are happening all around you—some even inside you.

The Human Body

Did you know that the process of eating involves both physical and chemical changes? Every time you chew food, your teeth break it into small pieces. This is a physical change; the food is getting smaller and changing shape as your teeth take bites out of it.

At the same time as you are busy chewing, a chemical change happens. Your **saliva** begins to break the food down into new substances. After you swallow, the acid in your stomach and intestines create even more chemical changes. These chemical changes **transform** the food into substances the body can use to produce the energy it needs to survive.



Digestion begins in the mouth.

Digestion continues in the stomach and intestines.

ACTIVE READER

1 Extend *Read the list. Write* C *next to chemical changes. Write* P *next to physical changes.*

_____ Cooking pancakes

_____ Clipping your nails

_____ Burning a candle

_____ Cutting your hair

_____ Toasting marshmallows

_____ Breaking a glass

_____ Making hot chocolate

Good to Know

Too much acid in your stomach causes a stomachache. When this happens, you might take an anti-acid. It reacts with the stomach acid to produce water and a type of salt, so that you are no longer uncomfortable.

Industry

Chemical and physical changes are also important in factories. In fact, just as you use heat to cook in your own kitchen, manufacturers use heat to create both chemical and physical changes.

In your kitchen you probably have many plastic containers. All plastics are made in factories by combining chemicals, resulting in chemical reactions. You probably have many plastic items in your home, such as toothbrushes, measuring cups, pens, and garbage cans.

Welding is an example of physical change. Anything made of metal—from a car to a bed frame—has to be welded together. To weld metals together a worker mixes burning oxygen and another gas in a blow torch. The blow torch heats a soft metal called solder until it melts. The solder acts like glue. Only then can the two or more pieces of melted metal be welded together. Melting and joining the metal are both physical changes.

Welding causes a physical change.

FOCUS QUESTIONS

1. **What could you do to a piece of paper to change it physically?**

_____

2. **What could you do to a piece of paper to change it chemically?**

_____

ACTIVE READER

1 Explain *Why is welding a physical change instead of a chemical change?*

_____

_____

_____

_____

_____

_____

_____

We enjoy fireworks every Independence Day thanks to chemical changes. The fireworks' different colors are produced by different chemicals. Sodium creates yellow, magnesium creates white, and calcium creates orange. Use the Internet to find out which chemicals create blue, green, and red.

Stop and Think

This page will help summarize what you have read so far. The following questions are similar to those in the Ohio Achievement Assessment in Science about chemical changes. Use the tip to help you answer the questions.

Tip:
Define physical change and chemical change in your own words.

1. Which is an example of physical change that occurs while eating?

Ⓐ tasting the food
Ⓑ chewing the food
Ⓒ smelling the food
Ⓓ swallowing the food

2. Which is an example of chemical change that occurs while eating?

Ⓐ freezing the food
Ⓑ preparing the food
Ⓒ swallowing the food
Ⓓ breaking down the food

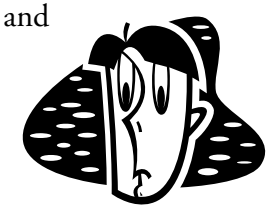
3. Which is an example of physical change required to make a metal desk?

Ⓐ designing the desk
Ⓑ deciding on a price for the desk
Ⓒ welding together the legs on the desk
Ⓓ burning gas and oxygen inside the torch

4. Which is an example of chemical change required to make a metal desk?

Ⓐ buying the desk
Ⓑ designing the desk
Ⓒ deciding on a price for the desk
Ⓓ burning gas and oxygen inside the torch

Dear Ms. Understanding,



During breathing and eating, people get energy from food. But plants get energy from the sun. Is this a chemical change, too?

Big Thinker in Bowling Green

Dear Thinker,

You are on to something. Plants get energy from the sun by a process called photosynthesis. Plants change the carbon dioxide, water, and light energy into sugars they use to live. If you're curious, here's the basic formula for photosynthesis:

$6CO_2 + 6H_2O$ (+ light energy) $+ C_6H_{12}O_6 + 6O_2$

In other words:
Carbon Dioxide + Water (+ light energy) + Sugar + Oxygen

Ms. Understanding

Design an Experiment A group of students has heard that adding salt to water can change its boiling point and freezing point. They want to investigate this. First, they boil a cup of water without salt. Then, they boil a cup of water with a tablespoon of salt. Finally, they freeze the cups of water. What else must the students consider during this experiment?

1. **What measurements must the students take during the experiment?**

2. **What instrument(s) do they need in order to take these measurements?**

3. **Look at the list below. Circle the materials the students need in order to complete the experiment.**

Lab Materials				
compass	electric burner	paper	oven mitt	pencil
cooking pot	ruler	rubber gloves	scale	scissors
thermometer	test tube	stove	freezer	measuring cup

4. **What safety procedures should the students follow?**

5. **The students discover that salt lowers the freezing of water. How is this knowledge applied in winter when there is ice on the roads and sidewalks?**

Glossary

carbon – a black substance made by burning

chemical changes – changes that happen at the molecular level, making one or more new substances

chemistry – the study of mixing chemicals

excessive – more than is necessary

irreversible – not able to be reversed

leavening agents – ingredients used to make baked goods rise

matter – a solid, liquid, or gas

molecular – related to molecules

molecules – the smallest unit of a matter that still has the parts

oxidation – the process where oxygen mixes with another substance

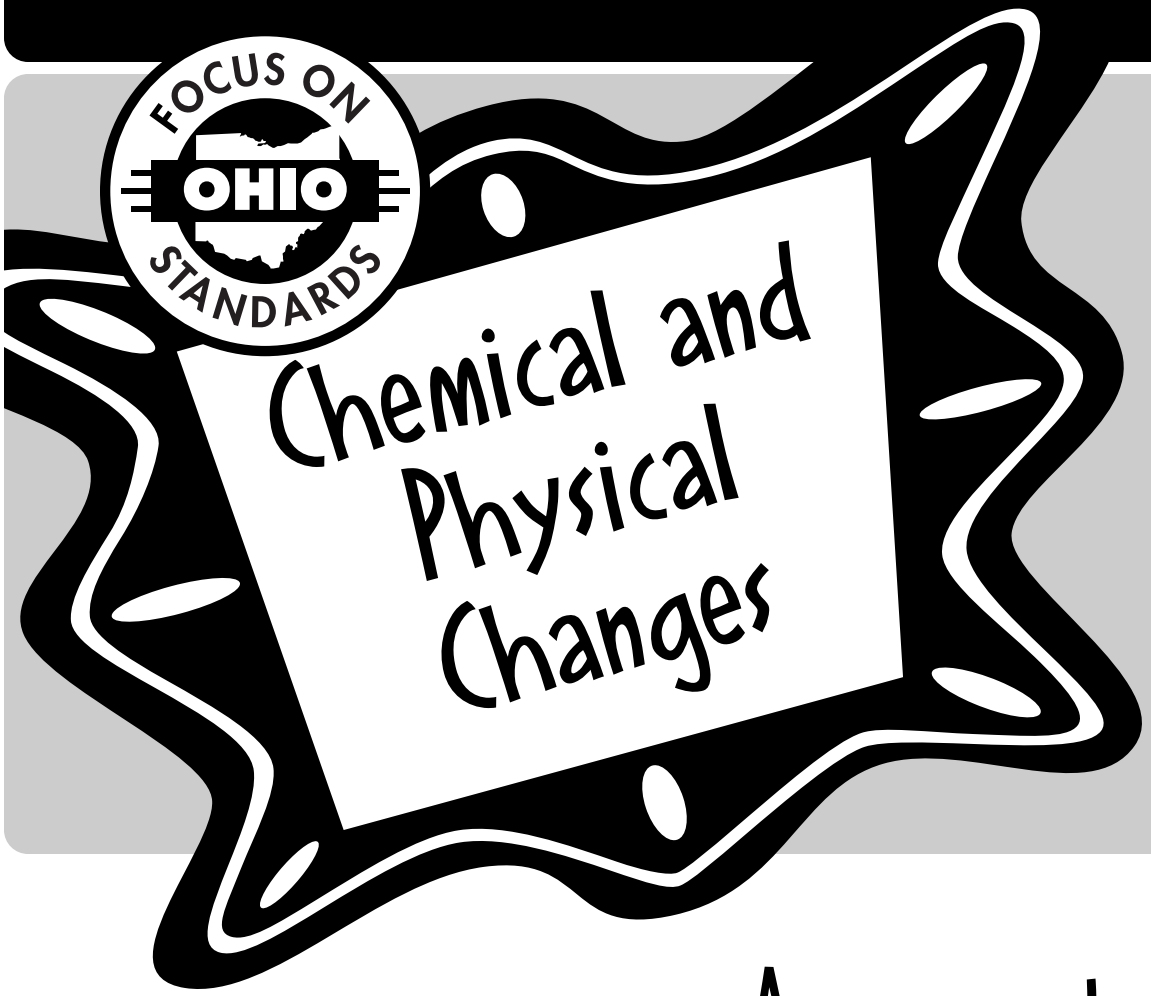
physical changes – changes that do not change the identity of the substance

saliva – watery liquid in the mouth that helps you ea

substance – a kind of matter

tarnish – black coating that appears on silver when air touches it

Physical Sciences



Physical Sciences
Benchmark A, Grade-Level Indicators 2, 3, 4

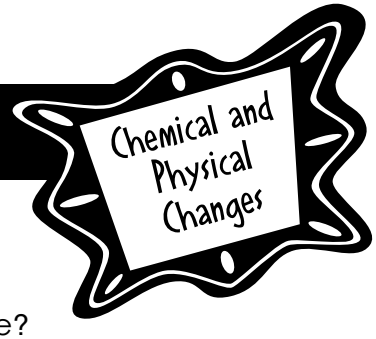
Scientific Inquiry
Benchmark A, Grade-Level Indicator 2

Scientific Ways of Knowing
Benchmark A, Grade-Level Indicator 3

English Language Arts
Acquisition of Vocabulary 1, 4, 6
Reading Processes 2, 4, 5, 6
Reading Application 3, 5, 8

Assessments

Check Understanding



In your Answer Document, shade the circle next to the correct answer.

1. A recipe for waffles calls for the following ingredients:

   1 1/2 cups flour
   2 tablespoons brown sugar
   1 tablespoon baking powder
   1 teaspoon salt
   1 cup milk
   2 eggs
   1/2 stick melted butter

   Which types of change does preparing the 1/2 stick of melted butter require?

   A. a change in state and color

   B. a change in shape and state

   C. a change in shape and color

   D. a change in size and substance

2. Which process could be described as a physical change?

   A. slicing

   B. rusting

   C. burning

   D. digesting

3. What signs indicate that a chemical change is taking place?

   A. no new substacne is formed

   B. change in taste, change in smell, change in size

   C. change in taste, change in state, change in temperature

   D. a new substance is formed

4. On the class camping trip, students decided to roast marshmallows. After holding the marshmallows over the fire for a few minutes, they got nice and brown.

   What type of change took place during the roasting of the marshmallows?

   A. chemical, because the fire produced heat

   B. chemical, because the change cannot be reversed

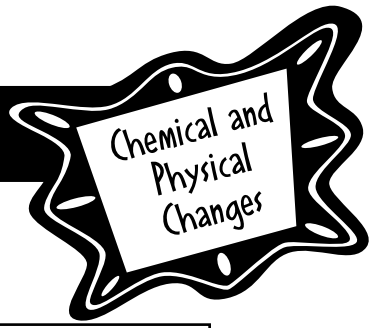
   C. physical, because the marshmallows only changed color

   D. physical, because the marshmallows could still be eaten

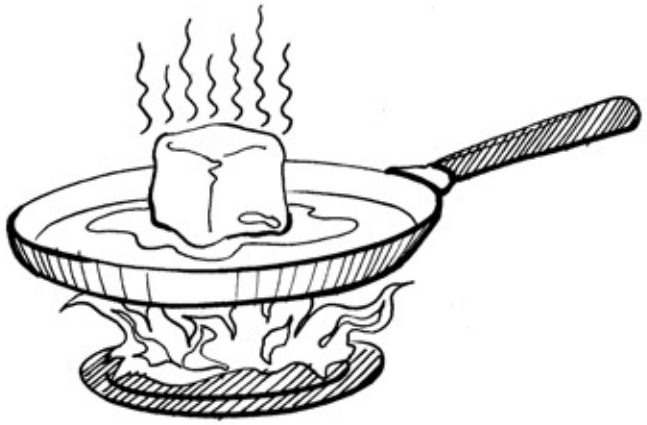
Answer Document

1.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		3.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
2.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		4.	Ⓐ	Ⓑ	Ⓒ	Ⓓ

Check Understanding



Use the following diagram to answer question 5.

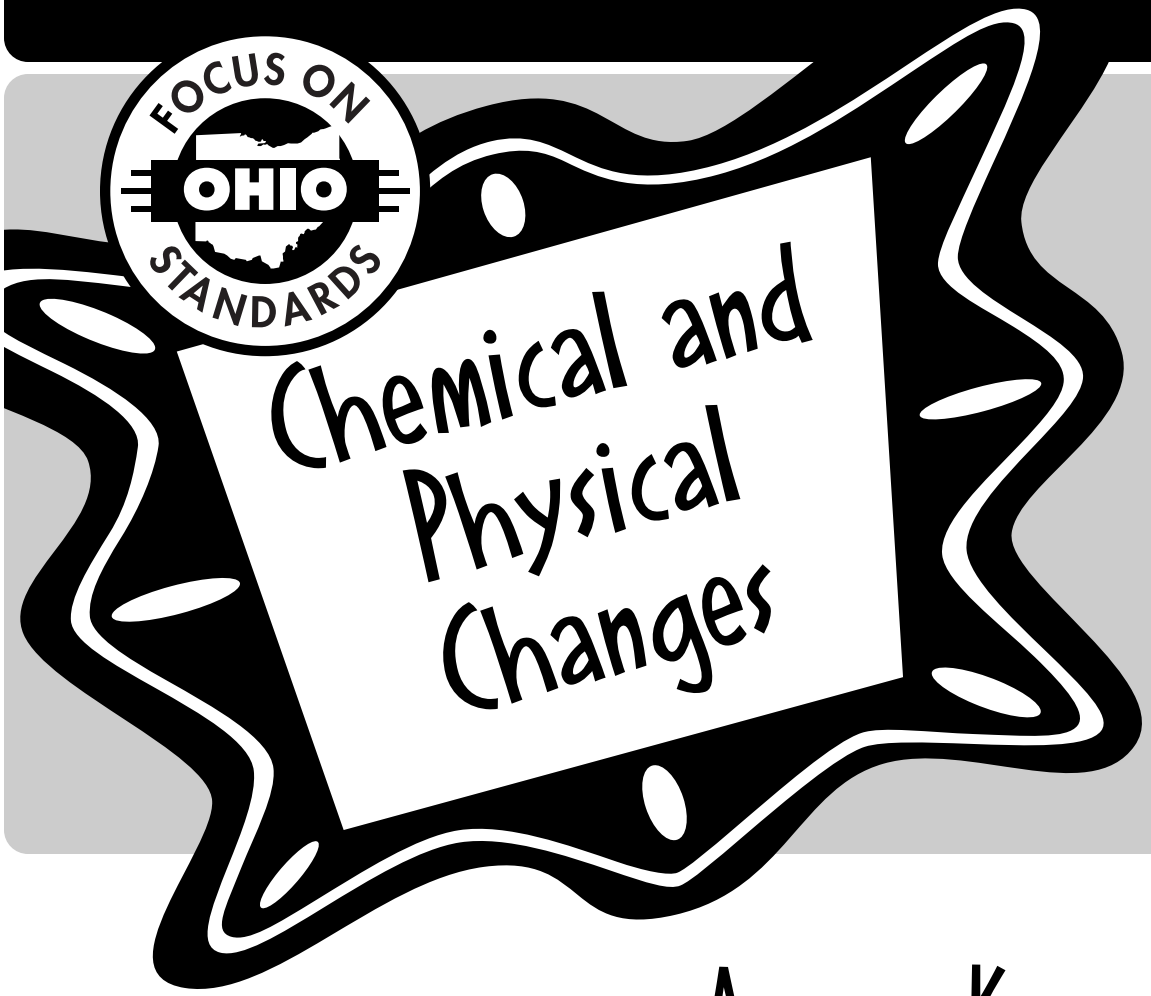


5. The picture above shows water in three states: solid, liquid, and gas.

   What kinds of change are needed to turn the ice into steam? Describe how you could show what types of change happened. (2 points)

Identify

Describe



Physical Sciences

Physical Sciences
Benchmark A, Grade-Level Indicators 2, 3, 4

Scientific Inquiry
Benchmark A, Grade-Level Indicator 2

Scientific Ways of Knowing
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English Language Arts
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Answer Key

Answer Key

Page 8: Starting Points: Build Background
Recall: The three states of water are solid, liquid, and gas. Answers will vary.
Predict: Answers will vary.
Label It: 1. Solids: rock, apple, icicle, chair; 2. Liquids: orange juice, lava, shampoo, tea; 3. Gases: oxygen, helium, hydrogen, nitrogen

Page 9: Starting Points: Build Background
Hands On Science: Investigate States of Matter: Ice: cold temperature, solid; Both: no smell; Water: cool temperature, liquid

Page 10: Starting Points: Key Vocabulary
Rate Your Knowledge: Answers will vary according to the student's prior knowledge.
Use Roots to Unlock Meaning:
1. Chemist: a person who studies the mixing of substances.
Interpret Metaphors: No, it would not have the same meaning because ice melts at room temperature.

Page 11: Starting Points: Key Concepts Physical and Chemical Changes:
Active Reader: Underline: Physical changes are changes in size, shape, or state. Circle: A chemical change creates a new substance.

Is the Change Physical or Chemical?:
1. Boiling water is a physical change because the water only changes state. 2. Rusting metal is a chemical change because the iron in the nail changes. 3. Sharpening a pencil is a physical change because the pencil only changes shape. 4. Chewing food is a physical change because only the shape of the food changes. 5. Wearing out running shoes is a physical change because only the shape of the shoes has changed.

Page 12: Chapter 1
Active Reader: 1. Changes in size, changes in shape, changes in state; 2. Main idea: Change in size is a physical change. Supporting details: Only a change in molecules would be a chemical change; Tearing lettuce with your hands does not break these molecules apart.

Page 13: Chapter 1
Active Reader: 1. Cut it in thin slices, wedges, or small pieces. 2. Sliced and wedged tomatoes have different shapes and sizes, but they are still both tomatoes.
Focus Questions: 1. Changes in size and changes in shape; 2. Sample answer: Cutting a piece of paper

Page 14: Chapter 1
Active Reader: 1. You need to add heat energy. 2. Ice cream will burn. The liquid water in it may evaporate.

Page 15: Chapter 1
Active Reader: 1. When you take the heat away, the liquid changes back to a solid. 2. Too high, applied for too long.
Focus Questions: 1. Fruit popsicles and fruit juice are made of the same substance. However, fruit popsicles are solids and fruit juice is a liquid. 2. Even when you take the heat away, the butter will not change back into unburned butter. The burned butter has different properties than unburned butter.

Page 16: Chapter 1
Stop and Think: 1. A; 2. D; 3. B; 4. Too much heat can result in a chemical change. It is no longer a physical change because the substance has changed into a new substance.

Page 17: Chapter 1
Think Like a Scientist: Classify Physical Changes: Answers will vary.

Page 18: Chapter 2
Active Reader: 1. black coating; 2. Heat, bubbling, and a color change

Answer Key

Page 19: Chapter 2
Active Reader: 1. Answers will vary. 2. It forms when molecules of iron combine with molecules of oxygen. 3. Apply oil to prevent the metal from coming in contact with water.
Focus Questions: 1. After a physical change, the substance is still the same substance. A physical change can be reversed. A chemical change results in a new substance and is irreversible. 2. The sulfur in air combines with the silver to create tarnish. The oxygen and moisture in air combine with the iron to create rust.

Page 20: Chapter 2
Active Reader: 1. Oxygen and heat; 2. Not able to be replaced

Page 21: Chapter 2
Active Reader: 1. It makes baked goods rise. 2. The biscuits would not rise.
Focus Questions: 1. After burning a substance, it is not possible to return the substance to its original form through a physical change. 2. The molecules change, making one or more new substances.

Page 22: Chapter 2
Stop and Think: 1. C; 2. B; 3. Rusting occurs when oxygen molecules in water combine with iron molecules. It is a chemical change because the interaction makes a new substance.

Page 23: Chapter 2
Hands On Science: Develop a Hypothesis: Sample answer: 1. It will rust. The steel wool is touching both the air and the water. 2. It will not rust. The oil keeps oxygen from getting to the steel wool, and without oxygen the steel wool cannot rust.

Page 24: Chapter 3
Active Reader: 1. C; 2. P; 3. C; 4. P; 5. C; 6. P; 7. P and C

Page 25: Chapter 3
Active Reader: 1. Welding melts the metal, but does not change the metal into a new substance.
Focus Questions: 1. Sample answer: You could tear, cut, or fold the paper. 2. Sample answer: You could burn the paper.

Page 26: Chapter 3
Stop and Think: 1. B; 2. D; 3. C; 4. D

Page 27: Chapter 3
Think Like a Scientist: Design an Experiment: 1. The students must measure the temperature of the cup of water when it starts to boil. They also must measure the temperature of the water in each cup when it starts to freeze. 2. They need a thermometer. 3. Circle: pencil, graph paper, cooking pot, thermometer, stove, freezer, measuring cup; 4. Students should wear the oven mitts when touching anything hot. 5. People put salt on the icy roads and sidewalks to melt the ice quickly.

Page 31: Assessments
Check Understanding: 1. B; 2. A; 3. D; 4. B

Page 32: Assessments
Check Understanding: 5. Physical changes are needed to change the ice to steam. Application of heat will melt the ice. Further application of heat will cause the water to evaporate into steam. You could prove these are physical changes by taking away the heat source and collecting the steam by placing a lid on the pan. The steam will return to liquid, and then the water will freeze into ice.