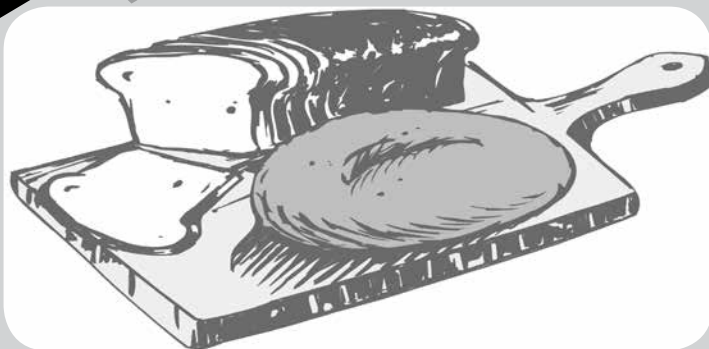


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# Chemical and Physical Changes

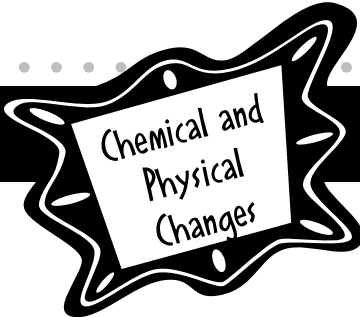
Basic Level



Physical Science  
Interactions Between Matter and Energy

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## Chemical and Physical Changes

### Scientific Inquiry

**Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.**

Develop, present, and defend formal research proposals for testing their own explanations of common phenomena, including ways of obtaining needed observations and ways of conducting simple controlled experiments.

Include appropriate safety procedures.

Design scientific investigations (e.g., observing, describing, and comparing; collecting samples; seeking more information, conducting a controlled experiment; discovering new objects or phenomena; making models).

### Physical Science

**Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.**

During a physical change a substance keeps its chemical composition and properties. Examples of physical changes include freezing, melting, condensation, boiling, evaporation, tearing, and crushing.

Mixtures are physical combinations of materials and can be separated by physical means.

During a chemical change, substances react in characteristic ways to form new substances with different physical and chemical properties. Examples of chemical changes include burning of wood, cooking of an egg, rusting of iron, and souring of milk.

## English Language Arts

The following is a selective listing of the competencies and indicators addressed in this book.

### Word Recognition

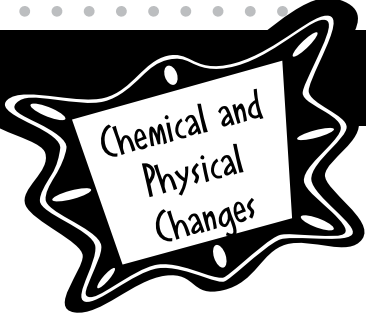
- Use word recognition skills and strategies quickly, accurately, and automatically when decoding unfamiliar words

### Background Knowledge and Vocabulary Development

- Use self-monitoring strategies to identify specific vocabulary difficulties that disrupt comprehension, and employ an efficient course of action, such as using a known word base or a resource such as a glossary to resolve the difficulty

### Comprehension Strategies

- Use a variety of strategies (e.g., summarizing, forming questions, visualizing, and making connections) to support understanding of texts read



## Chemical and Physical Changes

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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

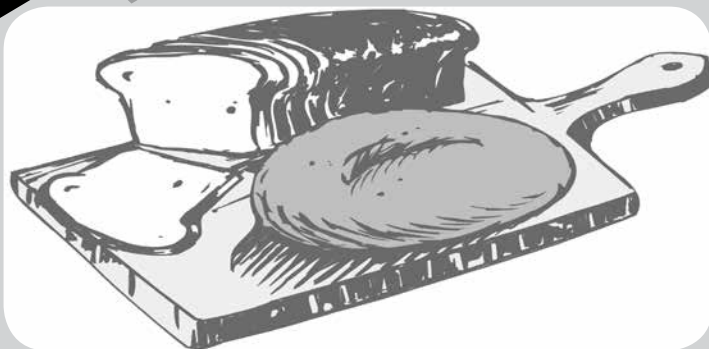
Student Book: print pages 5–28

Assessments: print pages 29–32

Answer Key: print pages 33–36

**FOCUS  
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SCIENCE**

# Chemical and Physical Changes



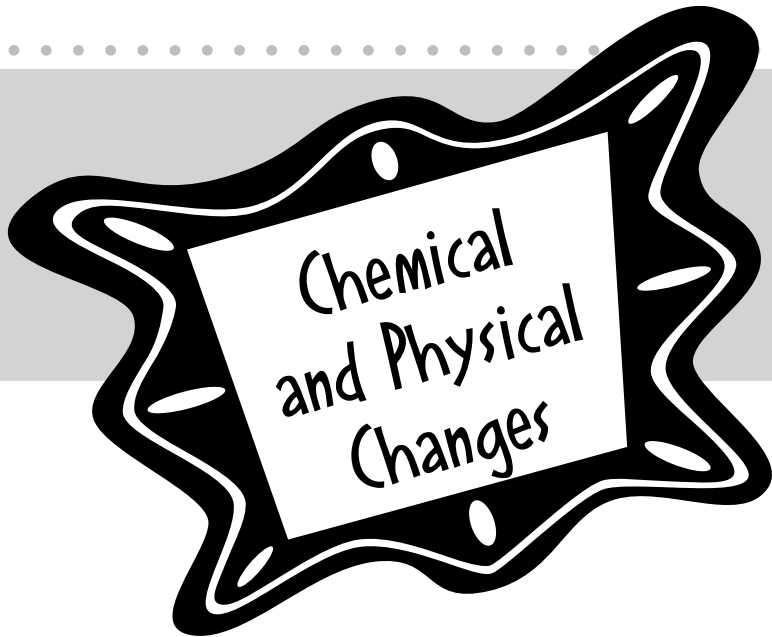
**How do the properties and interactions of matter and energy explain physical and chemical change?**

Changes happen around you everyday. An ice cube melts when you put it in a glass of warm soda. A bicycle rusts if left out in the rain. Scientists classify changes such as these in two groups: chemical and physical changes.

For example, slicing bread is a physical change. The bread changes shape, but it is still bread. Toasting bread is a chemical change. The bread is burnt and no longer soft. Burning creates a chemical change.

Read on to learn more about how to identify both types of changes.

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# Table of Contents

## Starting Points

Build Background .....	8
Hands On Science: Investigate States of Matter .....	9
Key Vocabulary .....	10
Key Concepts .....	11

## Chapter 1 Physical Changes

Changes in Size .....	12
Changes in Shape .....	13
Changes in State .....	14
Melting Versus Burning .....	15
Stop and Think .....	16
Think Like a Scientist: Classify Physical Changes ..	17

## Chapter 2 Chemical Changes

Extreme Changes .....	18
Rusting .....	19
Burning .....	20
Baking .....	21
Stop and Think .....	22
Hands On Science: Develop a Hypothesis .....	23

## Chapter 3 Changes All Around

The Human Body .....	24
Industry .....	25
Stop and Think .....	26
Think Like a Scientist: Design an Experiment .....	27

<b>Glossary</b> .....	29
-----------------------	----

<b>Assessments</b> .....	30
--------------------------	----

<b>Answer Key</b> .....	33
-------------------------	----



# Build Background

## Recall

Water can exist in three different states, depending on temperature. What are the three states of water? Write a sentence or two describing the three states of water.

---

---

## Predict

Putting vinegar and baking soda together causes a chemical change. 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. Then, write a label in the gray box that describes the words in the list.

①	
	rock
	plastic
	icicle

②	
	juice
	lava
	shampoo

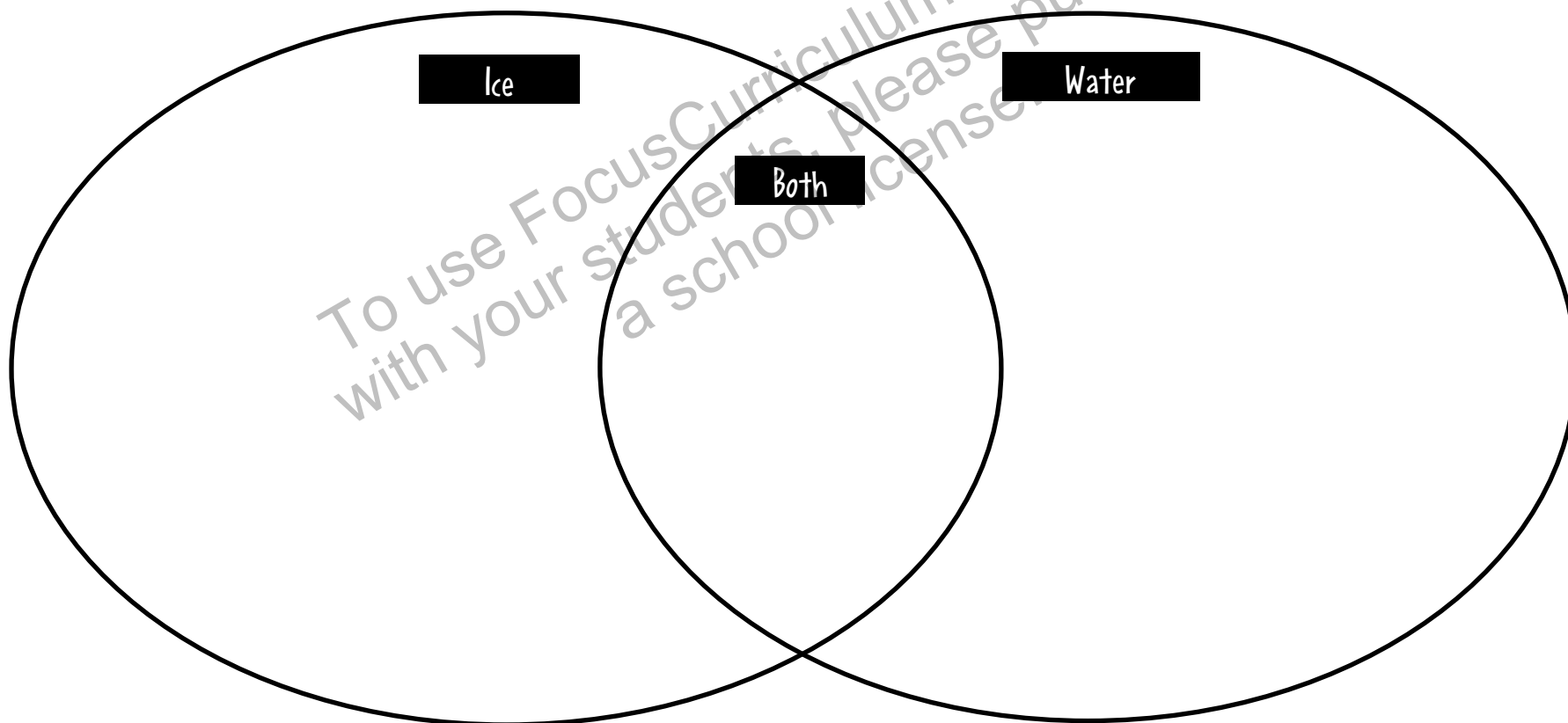
③	
	oxygen
	helium
	air





**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.





# 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.

\_\_\_\_\_  
\_\_\_\_\_

## States of Matter

Most matter on Earth exists in one of three states: solid, liquid, or gas. Each state of matter has its own physical properties. A block of wood is a solid. So is your desk at home or at school. A computer is also a solid. Matter that is solid has a certain size and shape. It does not change its size or shape unless something causes it to change. Milk is a liquid. It has size and volume. Milk does not have a particular shape, though. It takes the shape of its container. Liquids can flow, be poured, and be spilled. Solids cannot. Gases are matter that has no shape or size of its own. The air around you is a mixture of gases. You can't see air, but you can feel it.

Matter can change its state from one to another in the following ways:

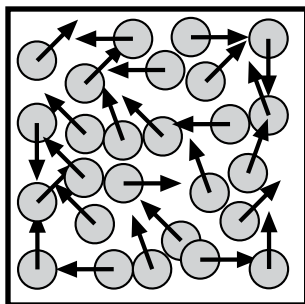
**Melting:** Melting occurs when a substance changes from a solid to a liquid.

**Boiling:** Boiling is when a substance changes from a liquid to a gas.

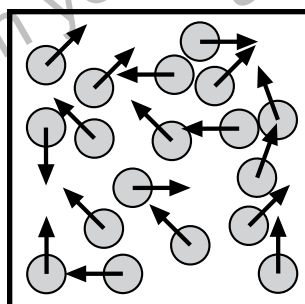
**Condensing:** When a gas becomes a liquid, it condenses.

**Freezing:** When a liquid changes to a solid, it freezes.

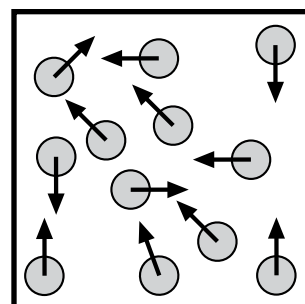
A change of state in matter results from the addition or removal of heat from a substance, which causes particles to move faster or slower.



Matter in a Solid State



Matter in a Liquid State



Matter in a Gaseous State

## Good to Know

What is matter made of? All matter is made of atoms, either the atoms of one element, or the atoms of more than one element. An element cannot be separated into other substances. Gold is an example of an element.

Water is made from two elements, hydrogen and oxygen, whose atoms are joined together chemically. Such substances are called compounds.

Elements and compounds can be combined in some substances, but not joined chemically. These substances are called mixtures. Mud is an example of a mixture. It contains water and soil. A fruit salad is another example of a mixture.

# Chapter 1 Physical Changes

## FOCUS

The underlined sentences tell important ideas about physical changes. Read this section. Find out about different kinds of physical changes. Think of examples of physical change that you might see 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. He is 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 there is a physical change, the object is still made of the same material. It just looks different.

## Changes in Size

Think about making a salad. You usually do not give someone a huge head of lettuce to eat. Instead, you tear the lettuce leaves into small bites. This is a physical change. The lettuce is still crisp and leafy. But it is physically changed into bite-size pieces.



Cutting lettuce and other food to make a salad is a physical change.

## ACTIVE READER

**1 List** Name three kinds of physical changes.

- a. \_\_\_\_\_  
\_\_\_\_\_
- b. \_\_\_\_\_  
\_\_\_\_\_
- c. \_\_\_\_\_  
\_\_\_\_\_

## Changes in Shape

A change in shape is another kind of physical change. Think about that salad again. I like tomatoes in my salad. A tomato can change shape in many ways. For example, my uncle likes very thin round slices. My mom likes to cut tomatoes into wedges. Both of these are physical changes. A tomato can be cut into many different shapes. But all of the pieces are still tomato.

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 in everyday life?

---



---

## ACTIVE READER

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

---



---

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

---



---



---



---

## Good to Know

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

## FOCUS

Read the next section about changes in state. As you read, remember that changes in state are physical, not chemical, changes.

## Changes in State

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. In other words, you freeze it.

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.

How do you know if a substance has changed state? Add or remove heat and see if it changes. What happens if you leave the frozen fruit juice sitting out on the table? The solid melts and turns back into liquid. It has the same properties as before it was frozen. It contains the same ingredients. 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 to do in order to change a solid to a liquid?*

**2 Words in Context** *Find the word ingredients in the text. What words in the next sentence tell you what ingredients means?*

## 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

My uncle has a great chocolate chip cookie recipe. The first time we made the recipe, I burned the butter. It turned from a yellow liquid to a smelly, dark brown mess.

My uncle explained what happened. When you heat a solid, it melts into a liquid. This is a physical change. You can prove that this is a physical change. If you put the melted butter back in the fridge, it changes back to solid butter.

However, excessive heat can cause a chemical change in some things. If the heat is too high, or the solid is heated for too long, it may burn. Burning can cause changes in color or smell. How can you prove a chemical change has happened? Even when you take the heat away, it will never change back into solid butter.

### 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.

---



---

### 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?

---



---



---

## Stop and Think

This page will help summarize what you have read so far.

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

- |                                   |                                          |
|-----------------------------------|------------------------------------------|
| (1) slicing a loaf of bread       | (3) making vanilla ice cream             |
| (2) making chocolate chip cookies | (4) pouring juice from a glass to a bowl |

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

- |                               |                                          |
|-------------------------------|------------------------------------------|
| (1) freezing water into ice   | (3) making chocolate chip cookies        |
| (2) burning a stick of butter | (4) pouring juice from a glass to a bowl |

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

- |                             |                                   |
|-----------------------------|-----------------------------------|
| (1) making ice cream        | (3) burning a stick of butter     |
| (2) freezing water into ice | (4) making chocolate chip cookies |

Base your answers to questions 4 and 5 on the following information and your knowledge of science.

**Adding heat energy can cause a substance to change its state.**

### 4. What happens when excessive heat is added to a substance such as a raw egg?

---



---

### 5. Why is this not a physical change?

---



---

### 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 Massapequa*

### 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

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# Chapter 1 Chemical Changes

## FOCUS

The underlined sentence tells an important idea about chemical changes. As you read, find out about three kinds of chemical changes.

## Extreme Changes

**Chemical changes** are different than physical changes. They create new substances. In a chemical change, the molecules break apart. They then join back together in a different way. This creates a new substance. A chemical change sometimes causes heat, bubbling, or a change in color.

Have you ever had to polish the silverware? Over time, silverware gets covered in a black coating. This coating is called tarnish. The silver changes to black when sulfur in the air touches it.

Because this chemical change takes place at the tiniest level, among the molecules, we cannot see it by just looking at it.



## ACTIVE READER

**1 Context Clues** 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 aren't 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 changes are good. Some are not. Let's look at one kind of bad chemical change: rust. Rust is not good for some metals like iron. It weakens them.

You may have seen rust on old nails or cars. Rust is an orange powder. Rust forms when oxygen in air or water touches iron. This process is called oxidation.

To keep my uncles cast iron pans from rusting, he rubs them with olive oil. It keeps air and water from getting to the iron and rusting it. For the same reason, it is also important keep your bike out of the rain.



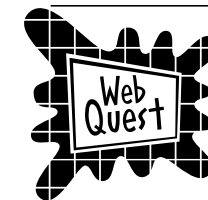
*This wagon is rusty. What could you do to prevent rust?*

## 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?*



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 QUESTIONS

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

---



---

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

---



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## 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 change? If you heat most things for a long time at a high heat, they will burn. Have you ever had cookies that were black on the bottom? They turned black because they got too much heat. The cookie dough burned, and made carbon—a new substance.

How can you tell that burning is a chemical change? Here's one easy way. Freeze the burned food. Then 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 change back.



*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.” Write the meaning of the word *irreplaceable*.

---



---

## Good to Know

Burning requires oxygen. Most fire extinguishers work by taking oxygen away from the fire. The extinguisher replaces the oxygen with another gas that doesn't burn easily.

## Baking

Many kinds of chemical change happens during baking. At first, muffins or biscuits are flat when they go into the oven. Then, they come out looking thick, soft, and fluffy. Leavening agents cause the muffins and biscuits to rise. Baking soda and baking powder are two kinds of leavening agents.

When a leavening agent is mixed with the wet ingredients in dough, then heated in the oven, it causes a chemical change. The chemical change makes bubbles in the dough. The bubbles lift the dough as it bakes. This makes the muffins thick, soft, and fluffy.

### ACTIVE READER

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

---



---



---

### 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.

---



---

## Stop and Think

This page will help summarize what you have read so far. Use the tip to help you answer the questions.

### 1. What is one sign of a chemical change?

- (1) change in size      (3) change in color  
(2) change in mass    (4) change in state

### 2. Carbon is produced by which chemical change?

- (1) baking                      (3) tarnishing  
(2) burning                    (4) oxidation

Base your answers to questions 3 and 4 on your knowledge of science.

### 3. How is rust produced?

---



---



---

### 4. Why is rusting considered a chemical change?

---



---



---

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

### 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 Schenectady*

### 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*



**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 tells an important idea about physical and chemical changes. As you read, look for 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.

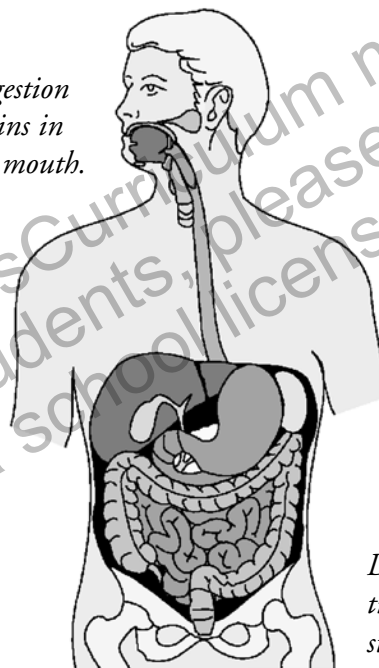
## The Human Body

Chemical and physical changes happen in the human body all the time. Did you know that eating involves both physical and chemical changes?

Every time you chew, your teeth break the food 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 change the food into new substances. After you swallow, the acids in your stomach and intestines change 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 important in factories. Just as you use heat to cook food, factory workers use heat to make both chemical and physical changes.

In your kitchen you probably have plastic containers. All plastics are made in factories. Plastics are made by mixing chemicals. Toothbrushes, measuring cups, pens, and garbage cans are made of plastic.

Welding is a kind of physical change that joins pieces of metal together. Car and bicycle parts are welded together. To weld metals together, a worker mixes burning oxygen and another gas in a blow torch. The high heat of the torch melts some of the metal. The melted metal acts like glue. It joins the pieces of metal 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 made by different chemicals. Sodium makes yellow. Magnesium makes white, and calcium makes orange fireworks. 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.  
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?

- (1) tasting the food                      (3) smelling the food  
(2) chewing the food                      (4) swallowing the food

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

- (1) freezing the food                      (3) swallowing the food  
(2) preparing the food                      (4) breaking down the food

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

- (1) designing the desk                      (3) welding together the legs on the desk  
(2) deciding on a price for the desk                      (4) burning gas and oxygen inside the torch

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

- (1) buying the desk                      (3) deciding on a price for the desk  
(2) designing the desk                      (4) burning gas and oxygen inside the torch

**Dear Ms. Understanding,**

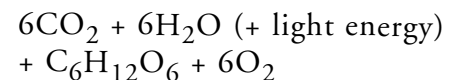
During respiration and digestion, people get energy from food. But plants get energy from the sun. Is this a chemical change, too?



*Big Thinker in the Bronx*

**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:



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?

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

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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?

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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?

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# Glossary

**byproduct** – an unneeded product that results during the production of something else

**carbon** – a black substance produced by burning

**chemical changes** – changes that occur at the molecular level, resulting in one or more new substances

**chemistry** – the study of substances and their interactions

**condensation** – the change from gas to liquid

**digestion** – the process of eating

**evaporation** – the change from liquid to gas

**excessive** – more than is necessary

**irreversible** – not able to be reversed

**leavening agents** – substances used to make baked goods rise

**molecular** – related to molecules

**molecules** – the smallest unit of a substance that still has the properties of that substance

**oxidation** – the combination of oxygen with another substance

**phenomenon** – an event

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

**respiration** – the process of breathing

**saliva** – watery liquid in the mouth that helps with digestion

**tarnish** – black coating that occurs on silver when exposed to air over time

**transform** – to change

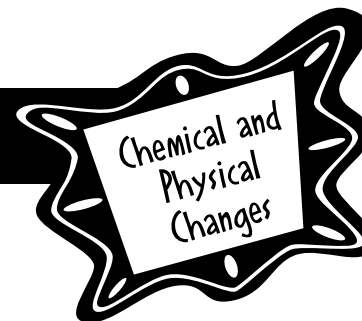
**FOCUS  
ON  
SCIENCE**

# Chemical and Physical Changes

Assessments

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# Check Understanding



In the Answer Document on this page, mark your answer in the row of circles for each question by filling in the circle that has the same number as the answer you have chosen.

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?

- (1) a change in state and color  
(2) a change in shape and state  
(3) a change in shape and color  
(4) a change in size and substance

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

- (1) slicing  
(2) rusting  
(3) burning  
(4) digesting

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

- (1) no new substance is formed  
(2) change in taste, change in smell, change in size  
(3) change in taste, change in state, change in temperature  
(4) 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.

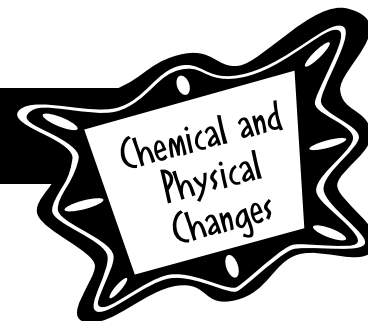
What type of change took place during the roasting of the marshmallows?

- (1) chemical, because the fire produced heat  
(2) chemical, because the change cannot be reversed  
(3) physical, because the marshmallows only changed color  
(4) physical, because the marshmallows could still be eaten

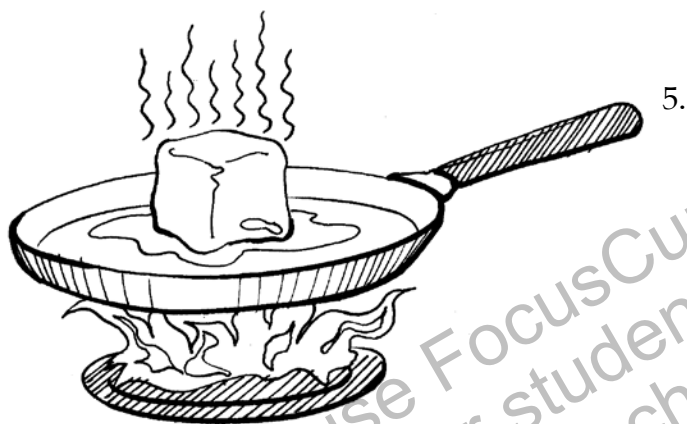
## Answer Document

- |    |   |   |   |   |    |   |   |   |   |
|----|---|---|---|---|----|---|---|---|---|
| 1. | ① | ② | ③ | ④ | 3. | ① | ② | ③ | ④ |
| 2. | ① | ② | ③ | ④ | 4. | ① | ② | ③ | ④ |

# Check Understanding



Base your answers to questions 5 and 6 on the diagram below and on your knowledge of science.



The picture above shows water in three states: solid, liquid, and gas. What changes occur that turn the ice into steam?

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6. Are the changes chemical or physical? How could you prove your answer?

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# Chemical and Physical Changes

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:

Chemist; a person who studies the mixing of chemicals.

Interpret Metaphors: No, it would not have the same meaning because ice melts and rock stays the same.

Page 12: Chapter 1

Active Reader: 1. Changes in size, changes in shape, changes in state.

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. Sample answer: Changes in size and changes in shape; 2. Cutting a piece of paper

Page 14: Chapter 1

Active Reader: 1. You need to add heat energy. 2. Words such as mixes and cream, sugar, eggs, and vanilla are clues.

Page 15: Chapter 1

Active Reader: 1. When you take the heat away, the properties are the same as before it was heated. 2. Too high, heated 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.

Page 16: Chapter 1

Stop and Think: 1. (1); 2. (4); 3. (2); 4. Excessive heat can result in a chemical change. In this case it causes the liquid egg and yolk to become a solid.; 5. It is not a physical change because the substance has changed into a new substance. the change cannot be reversed.

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. Underline: Rust forms when oxygen in air or water touches iron.

3. Put oil on it to stop water touching the metal.

Focus Questions: 1. After a physical change, the substance is still the same. A physical change can be reversed. A chemical change makes something new and is irreversible. 2. The sulfur in air mixes with the silver to create tarnish. The oxygen and moisture in air mixes 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. 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. (3); 2. (2); 3. Rusting occurs when oxygen molecules interact with iron molecules in the presence of water.; 4. Rusting is a chemical change because the interaction results in a new substance. The change is not reversible.

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. (2); 2. (4); 3. (3); 4. (4)

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. (2); 2. (1); 3. (4); 4. (2)

Page 32: Assessments

Check Understanding: 5. Application of heat will melt the ice. Further application of heat will cause the water to evaporate into steam.; 6. Physical changes are needed to change the ice to 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.

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