Above Level

SCIENCE • GRADE 3

| California Content Standards |
| --- |
| Physical Sciences: 1.E |
| Physical Sciences: 1.F |
| Physical Sciences: 1.G |
| Physical Sciences: 1.H |
| Physical Sciences: 1.I |

# What Is Matter?

LOOK INSIDE FOR:

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

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# What Is Matter?
# California's Science Content Standards Met

## GRADE 3 SCIENCE

**PHYSICAL SCIENCES: 1—**Energy and matter have multiple forms and can be changed from one form to another. As a basis for understanding this concept:

**e.** Students know matter has three forms: solid, liquid, and gas.

**f.** Students know evaporation and melting are changes that occur when the objects are heated.

**g**. Students know that when two or more substances are combined, a new substance may be formed with properties that are different from those of the original materials.

**h.** Students know all matter is made of small particles called atoms, too small to see with the naked eye.

**i.** Students know people once thought that earth, wind, fire, and water were the basic elements that made up all matter. Science experiments show that there are more than 100 different types of atoms, which are presented on the periodic table of the elements.

## GRADE 3 ENGLISH LANGUAGE ARTS

**1.0 WORD ANALYSIS, FLUENCY, AND SYSTEMATIC VOCABULARY DEVELOPMENT**

***Vocabulary and Concept Development 1.4*—**Use knowledge of antonyms, synonyms, homophones, and homographs to determine the meanings of words.

**2.0 READING COMPREHENSION**

***Comprehension and Analysis of Grade-Level-Appropriate Text 2.3*—**Demonstrate comprehension by identifying answers in expository text.

***Comprehension and Analysis of Grade-Level-Appropriate Text 2.5*—**Distinguish the main idea and supporting details in expository text.

***Comprehension and Analysis of Grade-Level-Appropriate Text 2.6*—**Extract appropriate and significant information from the text, including problem and solution.

Above Level

SCIENCE • GRADE 3

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| Physical Sciences: 1.E |
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# Student Book

## *What Is Matter?*

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

# How to Make the Student Book

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

## First–Select the Paper

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

## Second–Check Printer Settings

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

## Third–Print EVEN Pages

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

## Forth–Print ODD Pages

When the even pages have printed, flip the stack of pages over to print the odd pages.

[Art: flipping the stack over to the opposite side.]

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

## Fifth–Fold the Book

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

## Sixth–Staple the Book

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

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

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

AL

What Is Matter?

## California's Science Content Standards Met

### GRADE 3 SCIENCE

**PHYSICAL SCIENCES: 1**—Energy and matter have multiple forms and can be changed from one form to another. As a basis for understanding this concept:

**e.** Students know matter has three forms: solid, liquid, and gas.

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**g**. Students know that when two or more substances are combined, a new substance may be formed with properties that are different from those of the original materials.

**h.** Students know all matter is made of small particles called atoms, too small to see with the naked eye.

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### GRADE 3 ENGLISH LANGUAGE ARTS

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FOCUS ON CALIFORNIA STANDARDS

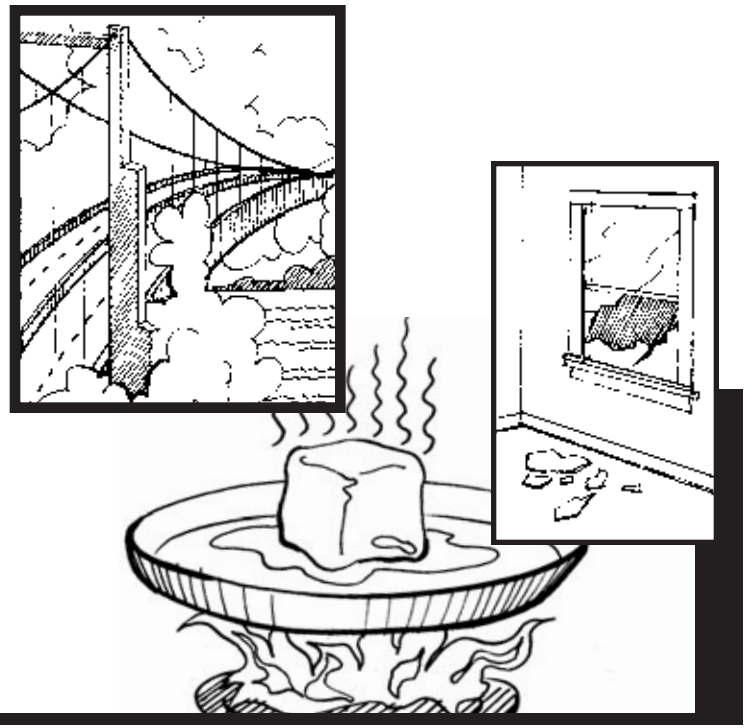
SCIENCE • GRADE 3

California Content Standards

Physical Sciences: 1.E, 1.F, 1.G, 1.H, 1.I

# What Is Matter?

by Charles Pederson




SCIENCE • GRADE 3

California Content Standards

Physical Sciences: 1.E, 1.F, 1.G, 1.H, 1.I

# What Is Matter?

by
Charles
Pederson

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## Table of Contents



*What do you think you will learn from this book?*

INTRODUCTION

# What Is Matter?

You use your senses to experience the world around you. You can feel a soft shirt. A delicious meal smells and tastes wonderful. You can see fluffy, white clouds. Many of the things in our world you can see, however there are also things you can't see. They still exist, though. For example, you can't see air, but you can feel it when a gentle breeze hits you.

Everything in the world—everything in the universe—has something in common. Everything is made of matter. What do you think matter is? Ancient peoples had some ideas about it. They thought matter was earth, air, water, and fire. These were the things they could see.

Today, we know that matter is anything with mass that takes up space. Mass is the amount of matter in an object. We also know that all matter is made of tiny particles called atoms. Matter is in everything, including gases we can't see.

**matter**: anything with mass that takes up space



People describe the physical **properties** of matter in many ways such as size, shape, color, texture, and **volume**. People also describe matter by the types of the material from which they are made. For example, paper is made from trees and other matter. Glass is made from melted sand.

## Types of Materials

| | |
|---|---|
| **Paper** | notebooks, cardboard boxes, newspaper, toilet paper, paper towels, photographs, books, bags |
| **Glass** | bottles, windows, sculptures, TV screens, pots, light bulbs |
| **Plastic** | keyboards, ski boots, CDs, brushes, soda bottles, bags, garbage cans |
| **Metal** | keys, doorknobs, belt buckles, wire, coat hangers, jewelry, knives, bolts |

*Describe other objects by the properties of the materials from which they are made.*

**properties**: qualities that something has
**volume**: the amount of space something occupies or takes up

CHAPTER 1

# Phases of Matter

Matter usually exists in one of three states, or phases—liquid, solid, and gas.

## Solids

A block of wood is 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.

## Liquids

Milk is a liquid. Milk 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 spilled. Solids cannot.

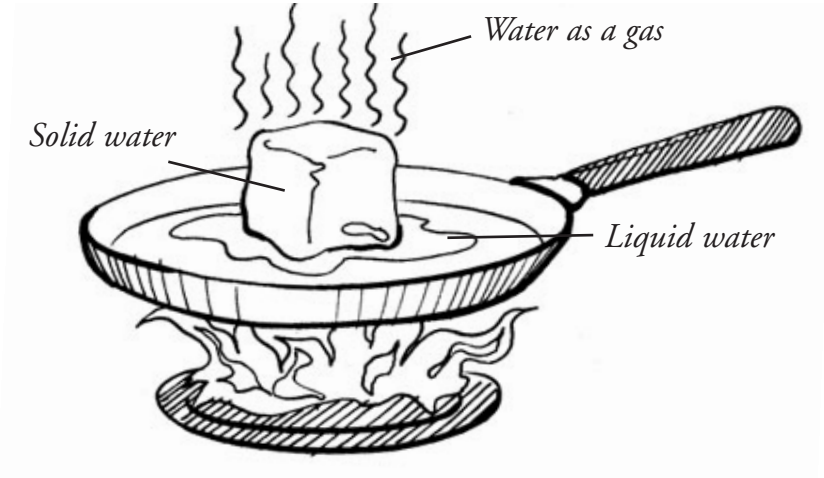
## Gases

Gases are matter take up space, or have volume. They push outward, or have pressure. But they do not have their own shape. The air around you is a mixture of gases. You can't see it, but you can feel it when the wind blows.

**phase**: a state of matter, usually liquid, solid, or gas



Water clearly demonstrates these three phases of matter. Liquid water is the sloshy, wet stuff you drink or wash with. It takes the shape of any container that holds it. Solid water is called ice. It has its own shape. Water as a gas can be seen as steam. Water as a gas can also be **invisible** in the air.




*When a solid is heated, it begins to melt. If heated enough, the melted liquid turns into gas or vapor.*

**invisible**: not able to be seen

CHAPTER 2

# Atoms and Elements

Thousands of years ago, people had different ideas about matter. One idea ancient people had was that there were four elements. These were earth, air, water, and fire. The belief was based on what people could see. These four things seemed to make up everything.

The ancient Greeks had a different idea. They thought all matter was made of tiny particles. They called these particles atoms. In the Greek language, *atom* means "uncuttable."

The ancient Greeks were right that atoms make up everything. They are the basic building blocks of everything. Think of a brick wall. The wall is made up of smaller bricks. Atoms are a little like the bricks. They build all matter.



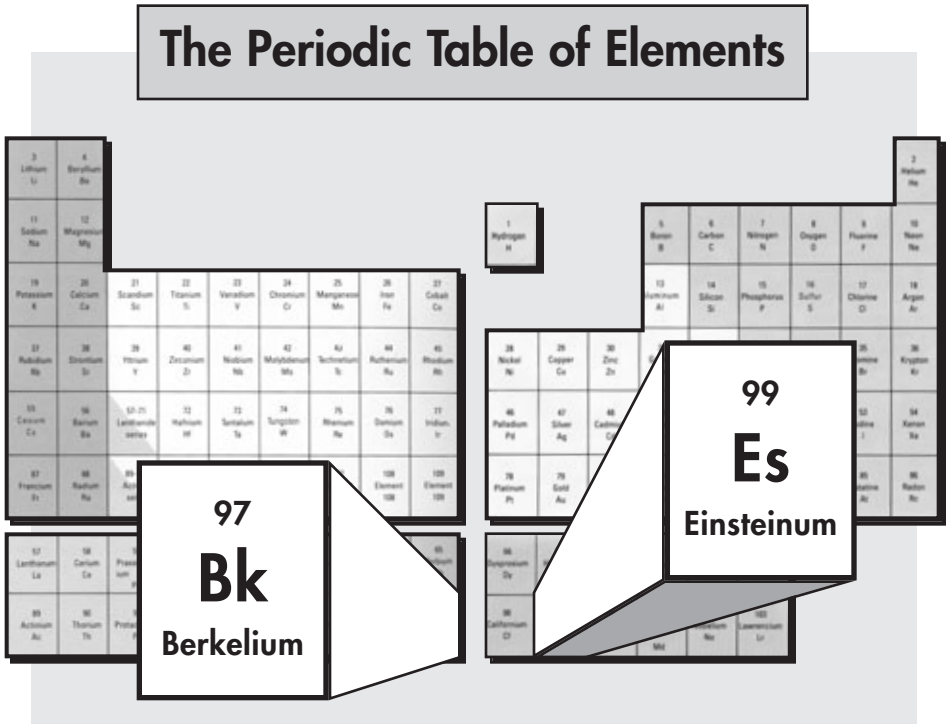
Imagine a sheet of aluminum foil. If you cut it in half, both halves are still aluminum foil. Now imagine cutting the foil in smaller and smaller pieces. The new pieces are still aluminum. At some point, there must a tiny piece that you cannot cut if it is still to be aluminum. That tiniest particle is an atom.

The ancient Greeks believed there were only a few types of atoms. Modern scientists performed experiments to test the idea. They discovered many types of atoms. Today, we know there are more than 100 types of atoms.

Each type of atom is called an **element**. Elements are substances that cannot be separated into simpler parts by ordinary means. Any element is made of atoms that are all alike. Gold, for example, is made only of gold atoms. No matter how small the piece of gold is, it is still gold. Scientists continue to discover new elements of previously unknown atoms.

**element**: a substance that cannot be separated into simpler parts by ordinary means

Many elements have interesting names. Some are named for scientists. Einsteinium, for example, is named after Albert Einstein. One element, berkelium, is named after the city where it was discovered—Berkeley, California. Below is part of a table that lists the elements.

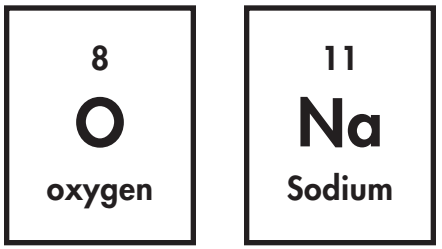



*The atoms of the different elements are arranged in a table. This Periodic Table of Elements help scientists keep track of them.*



The periodic table is arranged from simpler to more complex elements. Each element has a name and a symbol of one or two letters. For example, oxygen's symbol is *O*. Sodium's is *Na*.

Each element also has an atomic number. This describes how many smaller parts the element contains. These smaller parts are called protons and neutrons. The element with the fewest protons is hydrogen. Its symbol is *H*. It has one proton and no neutrons. Its atomic number is 1. The heaviest element found in nature is plutonium. Its atomic number is 94. It is more than 200 times heavier than hydrogen.




*Oxygen's symbol is* O. *It is listed eighth on the periodic table. Sodium's symbol is* Na. *Its atomic number is 11.*

CHAPTER 3

# Molecules

You know that matter is made of atoms. Atoms are the basic building blocks of everything. Atoms join in groups to create molecules. Molecules are made of different atoms grouped in specific patterns.

Molecules are a little like words, and atoms are like the alphabet letters. The same letters can be rearranged in patterns to form words. If you change the pattern, you get a new word.

For example, the letters *d-e-n* arranged one way mean "a place where animals live." Rearranged as *e-n-d*, they mean something else.

Molecules, too, form different substances when they are put in particular patterns. Two kinds of atoms, hydrogen and oxygen, for example, join to create water.

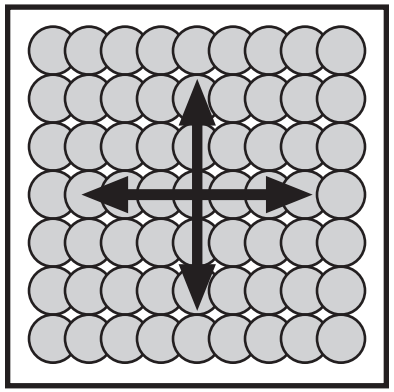


Molecules move faster or slower depending on a substance's state. The molecules of a solid can move only a little. They are tightly packed in place, providing shape and hardness. When the solid is heated, the molecules begin to move faster. They start to break away. At the temperature where the solid melts, it becomes a liquid. This temperature is called the melting point. Different kinds of solids have different melting points.

**Boiling Points of Different Substances**

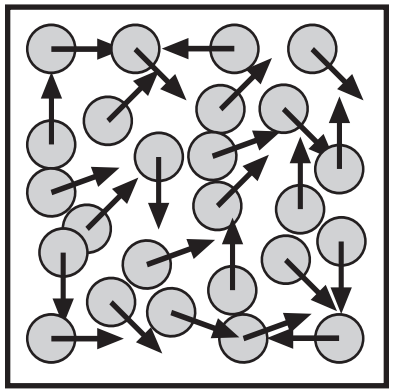
| | |
|---|---|
| Water | 212° F |
| Iron | 4,982° F |
| Oxygen | -297.4° F |

If heating continues, more molecules gain enough energy to break away from the liquid. They move into the surrounding space. This is called evaporation. If enough heat is added, the matter begin to bubble and escape as a gas. This is called boiling. All liquids have different boiling points. Water's boiling point, for example, is 212 degrees Fahrenheit or 100 degrees Celsius (212° F or 100° C).



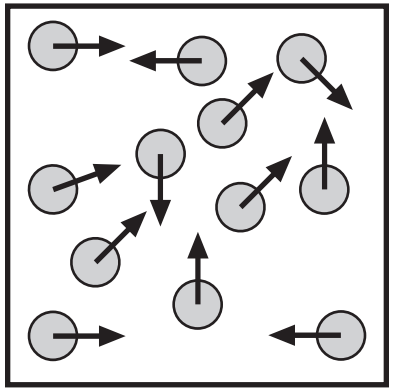
## Solids

*Solids have packed molecules. They can move very little and make a substance hard.*



## Liquids

*The molecules in liquids are able to move more.*



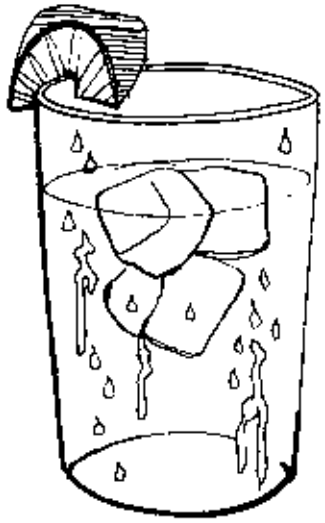
## Gases

*In gases, molecules are furthest apart. They can move in all directions.*



Subtracting thermal energy, or cooling, will also change the state of matter. If a gas cools enough, it **condenses**. If you have ever had a cold drink on a hot day, you have seen condensation. It is what forms the little water drops on the outside of your glass. The water vapor in the air condenses on the cold surface of the glass.

Continue to subtract thermal energy, and the liquid becomes a solid. For water, this is the point at which it becomes ice. Water's freezing point is 32° F or 0° C.



*Water condenses on the outside of cold glasses.*

**condense**: change from a gas to a liquid

CHAPTER 4

# Changes In Matter

## Physical Changes

Matter is always changing. One type of change is physical change. Physical change occurs when objects or substances change their forms, or states, of matter or **energy**.

For example, when heat is added or removed, the three states of matter may change. If heat is added, a solid may melt. Then it becomes a liquid. If that liquid is further heated, it may become a gas. If a gas is cooled, it may become a liquid or solid.

Think about steel. It is a hard metal. But if you add enough heat, it will melt. It becomes a liquid. The liquid is still steel, even though its color, temperature, and shape have changed.

Magma is rock that has been heated deep in Earth. When heated it changes from a solid to a liquid. When magma is released to the surface, it cools. It then becomes a glass-like solid.

**physical**: having to do with things that can be seen or measured
**energy**: the ability to change something



## Chemical Changes

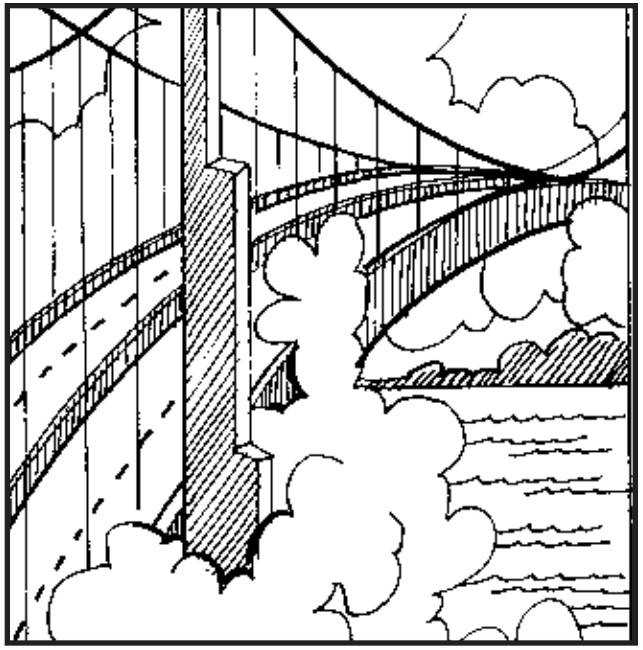
Physical change is one type of a change in matter. Another is chemical change. Chemical changes may occur when two or more substances are combined. Chemical changes are usually **permanent**. They not only change the way matter looks, feels, smells, or tastes, they also change the substances into something completely new. For example, when you burn wood, it turns into ash, smoke, and other gases. You cannot change the ash, smoke, and gases back into wood. This is a chemical change.

## Telling the Difference

Sometimes, seeing the difference between a physical and chemical change is easy. For example, a box may be filled with mixed paper and plastic to protect the contents. When the box is unpacked, it is easy to separate the plastic from the paper again. This is a physical change. It is not permanent.

**permanent**: unchanging

In some physical changes, the properties of a substance change. The substance may change size, shape, or state. For example, a solid may melt or a gas may condense to become a liquid. Physical changes do not produce or create a new substance, as chemical changes do.



*Fog swirling around a bridge is condensed water vapor. When the air temperature is cool enough, fog forms near the ground. This is a physical change. The water changes state, but it is still water, not a different substance.*



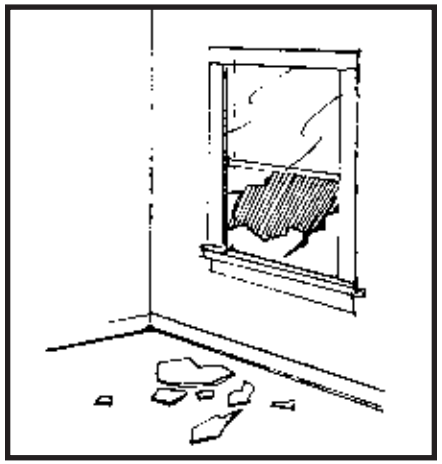
To help you decide if a change is physical or chemical, ask yourself two questions. If you can answer *yes* to either question, then it is a physical change. If you answer *no* to both questions, it is a chemical change.

1. **Are the physical properties the same after the change?** For example, you bend a piece of wire. The shape has changed, but it is still wire. The answer is, *yes*.

2. **Can the substance go back to the way it was? Or is the change reversible?** If sugar is dissolved in water, the sugar seems to disappear. If the cup is left in the sun, the water will **evaporate**. The sugar will remain behind. The answer here also is, *yes*.

*Identify the characteristics of a simple chemical change.*

**evaporate**: to change into a gas or vapor



*Glass scatters when a window breaks.*
*Is this a physical change or chemical change?*

*Poor snowman! The sun is beginning to melt him.*
*Is this a physical change or chemical change?*

*Identify the characteristics of a simple physical change.*



Matter is all around us. It makes the world we can see. It even makes things we can't see. Without matter, nothing would exist. With matter, everything exists!

Matter is always changing. Some changes are physical. Some are chemical. Without those changes, think how boring life would be. Nothing would be able to move. We couldn't eat hamburgers or yawn or play video games. Nothing would grow. The world would not turn. There would be no seasons. Everything would be as though it were frozen.

Thank goodness for matter and the changes it makes! Maybe you can grow up to be a scientist and discover something new about matter.

*Write several paragraphs that summarize the main ideas in this book.*

# Glossary

**condense**—change from a gas to a liquid

**element**—a substance that cannot be separated into simpler parts by ordinary means

**energy**—the ability to change something

**evaporate**—to change into a gas or vapor

**invisible**—not able to be seen

**matter**—anything with mass that takes up space

**permanent**—unchanging

**phase**—a state of matter, usually liquid, solid, or gas

**physical**—having to do with things that can be seen or measured

**properties**—qualities that something has

**volume**—the amount of space something occupies or takes up



# To Find Out More . . .

Want to learn more about physical changes?

**Try these books**

*Physical Changes* by Darlene R Stille. Compass Point, 2006.

*States of Matter* by Robert Snedden. Reed Educational and Professional Publishing, 2001.

*Solids, Liquids, and Gases* by Carol Ballard. Heinemann, 2004.

**Access these Web sites**

Chem4Kids.com
*http://www.chem4kids.com/files/matter_intro.html*

Change Is Cool
*http://www.usoe.k12.ut.us/curr/Science/sciber00/8th/matter/sciber/physchng.htm*

**Write for more information**

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# English-language Arts Activities

## *What Is Matter?*

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

# Summarize Main Ideas

**Summarizing means to retell what you have read. It helps you understand and remember what you read. Summaries are shorter than the text you read. Read this paragraph. Then try to summarize it.**

Matter can change its state from solid to liquid to gas. Water clearly shows these three states. Liquid water is the sloshy, wet stuff you can drink. It takes the shape of any container that holds it. Solid water is called ice. It has its own shape. When water evaporates, it can be seen as steam. Water as a gas is invisible in the air.

**Is it a good summary?**

Steam is the gas form of water.

**No! The statement is too specific. It does not summarize the main idea. Is the following a good summary?**

Matter, including water, usually is either a liquid, solid, or gas.

**Yes! It describes what the main idea of the paragraph.**

## TRY THE SKILL

**Read the paragraph. Then shade the circle next to its main idea.**

Physical change occurs when objects or substances change only their states of matter or energy. Matter is anything with weight or that takes up space. Energy is the power of forces in nature to do work. Many physical properties of matter can change. Some examples of properties that might change include color, shape, size, temperature, or weight. Others include density, flexibility, the ability to float or sink, shininess, and magnetism.

1. Which sentence best summarizes this paragraph?
   - Ⓐ Melting and rehardening iron is a physical change.
   - Ⓑ Color, shape, size, and temperature are physical properties.
   - Ⓒ Physical changes only change a substance's physical properties.

# Compare and Contrast

**Comparing tells how things are alike. Contrasting tells how things are different. Read the following paragraphs and the T-chart that compares and contrasts.**

Diffusion occurs without shaking or stirring. The atoms or molecules of a substance move throughout another substance until they are evenly distributed. This happens, for example, when a drop of dye is added to a glassful of water. Eventually, the dye is evenly spread through the water. You cannot distinguish the parts of the diffusion.

Suspensions are mixtures in which you can still see the different parts of it. Suspensions are stirred or shaken to mix their parts. When left alone, the parts will separate again. For example, a mixed salad is a suspension. So is the salad dressing of oil and vinegar. If you look closely, you can tell the oil from the vinegar.

| Diffusions | Both | Suspensions |
|---|---|---|
| • No shaking or stirring is needed.<br>• The parts are evenly distributed.<br>• The parts are not visible.<br>• The parts will stay mixed. | • Both are mixtures.<br>• Two or more ingredients are put together. | • Mixed by shaking or stirring.<br>• The parts may not be evenly distributed.<br>• The parts are still visible.<br>• The parts will separate. |

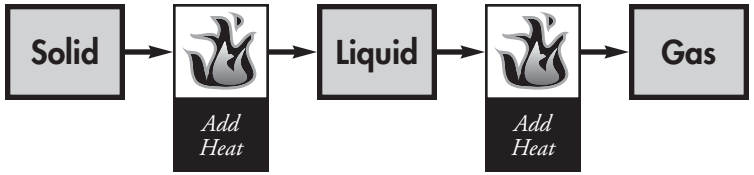
## TRY THE SKILL

**Read the following paragraph. Compare and contrast the information. Then create a graphic organizer to interpret the information.**

Water clearly shows these three states. Liquid water is the sloshy, wet stuff you can drink. It takes the shape of any container that holds it. Solid water is called ice. It has its own shape. When water evaporates, it can be seen as steam. Water as a gas is invisible in the air. Gases take up space, or have volume. They push outward, or have pressure. But they do not have their own shape.

# Read Graphic Information

**Charts, graphs, and diagrams are like pictures that give information. The diagram below shows what happens when heat is added to a substance. You can see that the form of the substance changes. Look at the chart below and the questions and answers.**




1. **What happens when heat is added to a solid?**

   It becomes a liquid or a gas.

2. **What happens when heat is added to a liquid?**

   It becomes a gas.

3. **Which of these would be the hottest—solid, liquid, or gas?**

   A gas would be the hottest.

4. **What do you think would happen if you removed heat energy from a liquid?**

   It would become a solid.

## TRY THE SKILL

**Look at the chart below and then answer the questions. Use complete sentences.**

**Boiling Points of Different Substances**

| | |
|---|---|
| Water | 212° F |
| Iron | 4,982° F |
| Oxygen | -297.4° F |

1. Put the boiling points in the chart from the lowest to the highest.

   _____

   _____

2. Which substance has the highest boiling point?

   _____

3. Which substance has a boiling point that is below 0° F?

   _____

4. Which substance needs the most energy to reach its boiling point?

   _____

# Antonyms

**Antonyms are words that have opposite meanings from each other. Some examples of antonyms are:**

*asleep* and *awake*
*eat* and *starve*
*sink* and *float*
*freeze* and *solidify*

**Read the following paragraph from *What Is Matter?* Look for antonyms.**

To change matter from one state to another, heat energy is either added or subtracted. Adding heat causes a solid to melt or to evaporate. It can cause substances to move from solid directly to a gas without melting. This process is called sublimation.

Subtracting energy causes gases to become liquids. They condense. Subtracting more heat causes the liquid to become solid, or freeze.

**What antonyms did you find?**

Antonyms include *added* and *subtracted*, *solid* and *liquid*, and *freeze* and *melt*.

TRY THE SKILL

**Read the following paragraph. Look for antonyms. Write them on the lines below.**

Molecules move more or less depending on a substance's state. The molecules of a solid can move only a little. They are tightly packed in place, providing shape and hardness. When heat is added to the solid, the molecules begin to move. They start to break away from their places. At the temperature where the solid melts, it becomes a liquid. This temperature is called the melting point. Different kinds of solids have different melting points.

Subtracting heat energy, or cooling, will also change the state of matter. If a gas cools enough, it condenses. If you have ever had a cold drink on a hot day, you have seen condensation. It is what forms the little water drops on the outside of your glass.

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# Answer Key

## Summarize Main Ideas

**1**. C

## Compare and Contrast

**Water as a Liquid**: It is called water. It is wet.

**Both**: Both are forms of water. Both take the shape of containers that hold them.

**Water as a Gas**: It is called steam. It is a vapor. It can be seen or not seen.

## Read Graphic Information

**1**. The boiling points in order are oxygen, water, and iron.

**2**. Iron has the highest boiling point.

**3**. Oxygen's boiling point is below zero.

**4**. Iron needs the most energy to reach its boiling point.

## Antonyms

more/less

cold/hot