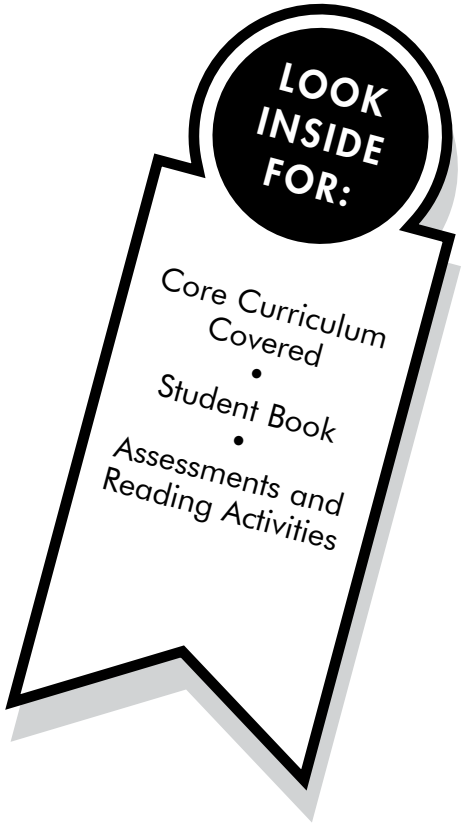
Earth Science

Water

On Level

Physical Properties of Water



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Physical Properties of Water

What makes water so special?

CORE CURRICULUM STATEMENTS

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

Matter takes up space and has mass. Two objects cannot occupy the same place at the same time.

Matter has properties (color, hardness, odor, sound, taste, etc.) that can be observed through the senses.

Objects have properties that can be observed, described, and/or measured: length, width, volume, size, shape, mass or weight, temperature, texture, flexibility, reflectiveness of light.

Measurements can be made with standard metric units and nonstandard units.

The material(s) an object is made up of determine some specific properties of the object (sink/float, conductivity, magnetism). Properties can be observed or measured with tools such as hand lenses, metric rulers, thermometers, balances, magnets, circuit testers, and graduated cylinders.

Objects and/or materials can be sorted or classified according to their properties.

Changes in the properties or materials of objects can be observed and described.

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Student Book

Physical Properties of Water

OL

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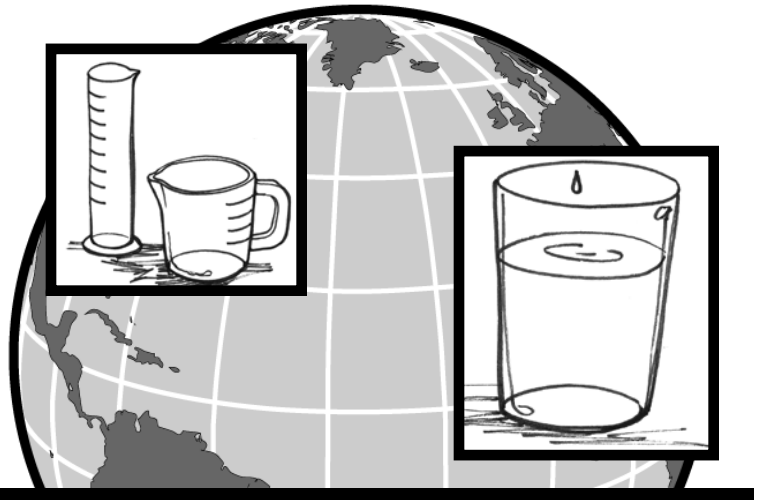
FOCUS ON SCIENCE

Earth Science

Water

Physical Properties of Water

by Caitlin Scott



FOCUS ON SCIENCE

Earth Science

Water

Physical Properties of Water

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Curriculum materials for **your** content standards

Table of Contents

– Predict –
What do you think you will learn from reading this book?

Water takes many forms on our planet, such as oceans, lakes, rivers, and glaciers.

Water Is Everywhere

It covers about 70 percent of our planet. It makes up about 65 percent of your body. It is always changing. It can cover your house in a white blanket in winter or cool you off on a hot summer day. Every plant, animal, and human being needs it to survive. What is it? Water.

Some people think our planet was misnamed. Instead of planet Earth, we should call it planet Water. While water changes all the time, there is always the same amount of water on our planet. Understanding water helps us protect and use this important **natural resource**.

natural resource: a valuable substance found on Earth that is useful to humans

CHAPTER 1

What Is Water?

Scientists **observe** water to discover more about it. You can make **observations** about water, too.

Use Your Senses

Start with a glass of tap water. Use your eyes to observe the water in the glass. What does the water look like? It should appear clear and colorless.

What shape does the water have? It should be shaped just like the glass you have poured it in, because water always takes the shape of its container.

Use your nose to tell what water smells like. Unless water is mixed with something else, water should be **odorless**.

observe: to study carefully
observations: things discovered through careful study
odorless: to have no smell

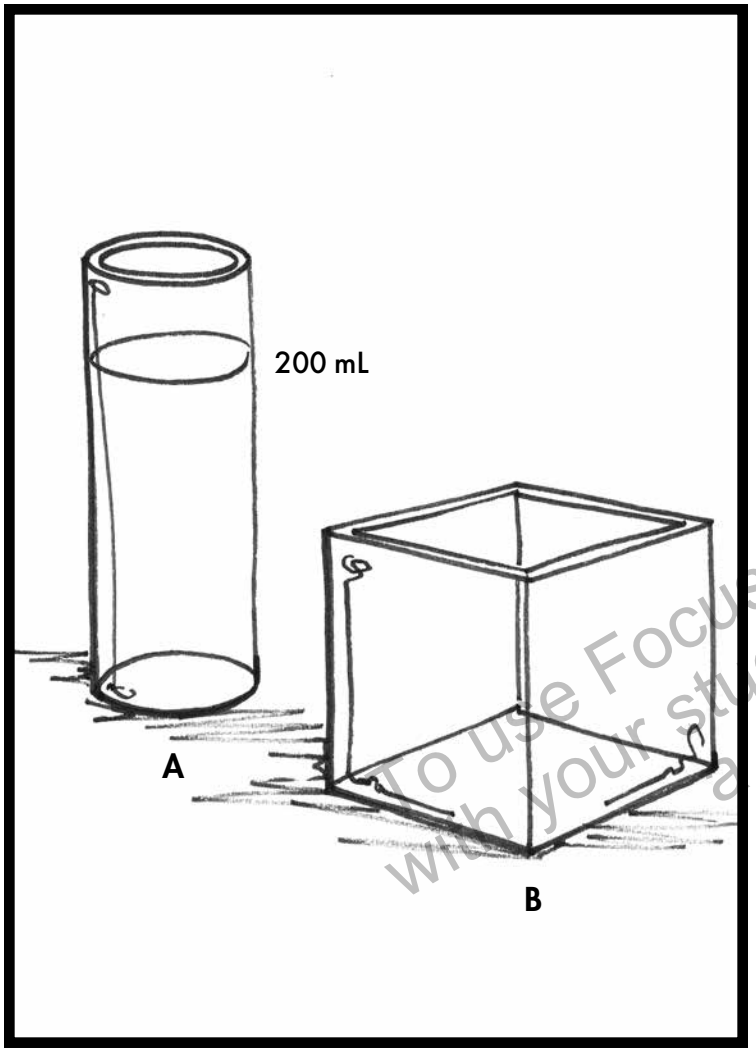
What does water taste like? Water is mostly tasteless. If you taste something, it is probably something that was mixed with the water. Use your ears to listen to the water. Water in a glass is silent.

However, not all water is like the water that comes out of the faucet in your kitchen. There are other forms of water. For example, there is water in oceans, water in mountain streams, water frozen in polar ice caps, and water droplets in clouds.

Water can take three different forms: solid, **liquid**, or gas. In this book, you will learn more about liquid water.

– Investigate –
What else can you observe about water?

liquid: a state of matter that has a definite volume but no definite shape



If you pour the water in container A into container B, it will change shape. It will not change in volume.

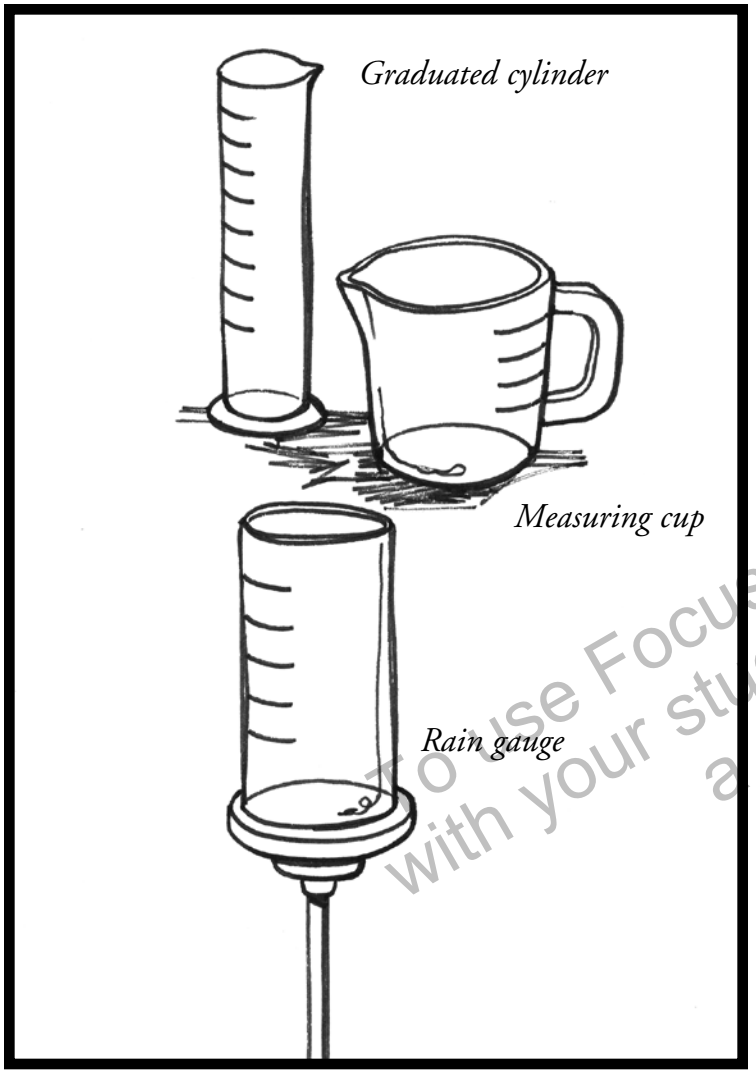
Shape and Volume

Shape is the form an object has. Water is a liquid, so it always takes the shape of its container. Try pouring water from a cup to a bowl. In the cup, the water is shaped like the cup, but in the bowl the water takes the shape of the bowl.

Volume is a measure of the amount of space an object takes up. If you pour the same amount of water from one container to another, the volume does not change even if the containers are shaped differently. You will always have exactly the same amount of water.

– Explain –
What is the difference between shape and volume? Share your answer with a friend to help you remember.

shape: an object's form
volume: a measure of the amount of space an object takes up



These standard tools can measure water volume. If you pour water from one container to the other, what will happen? It will change shape, but the volume of the water will remain the same.

Measuring Water

How can we measure water volume? People have invented many ways. Here are some of them.

Measuring cups: Cooks use measuring cups. These cups measure the amount of water for a recipe. Without measuring cups, it would be hard for cooks to prepare food the same way each time.

Graduated cylinders: Many scientists use graduated cylinders. These containers measure the volume of water for experiments. Scientists need correct measurements to repeat their experiments.

Rain gauges: Meteorologists and other scientists use rain gauges. These gauges measure how much rain has fallen. Scientists can measure rainfall over time. They record how much rain falls each day, each month, and each year.

CHAPTER 2

Sink or Float?

What goes up must come down. Why is this? Because of a force called **gravity**. Gravity pulls everything toward the Earth, but it pulls down more strongly on objects that have more **mass**.

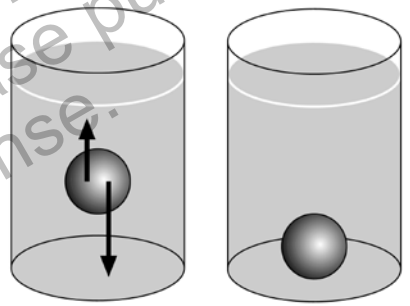
Water can stop the force of gravity. Have you noticed that some objects like rocks sink when you drop them in water while other objects like boats float? This is because of **buoyancy**. Buoyancy is a force that pushes objects upward. Here is how it works.

Have you noticed that when you get into the bathtub the water rises? This is because the water is **displaced**. In other words, the water moves to make room for your body. This causes the water level to rise.

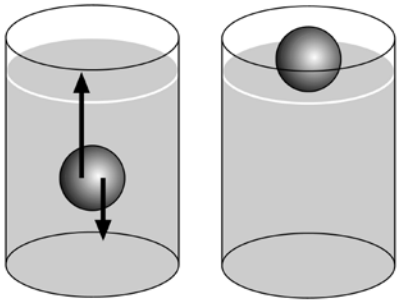
gravity: the downward force that pulls objects toward the Earth
mass: the amount of matter in an object
buoyancy: the upward force that causes objects to float
displaced: moved out of the way

Anytime water is displaced, the water level rises. This creates an upward force. This force is buoyancy.

Whenever an object is placed in water, buoyancy and gravity work together. When the force of gravity is stronger, an object sinks. When the force of buoyancy is stronger, an object floats.



If the force of gravity is stronger, objects sink.



If the force of buoyancy is stronger, objects float.

– Compare –
What is the difference between gravity and buoyancy?

Experiment

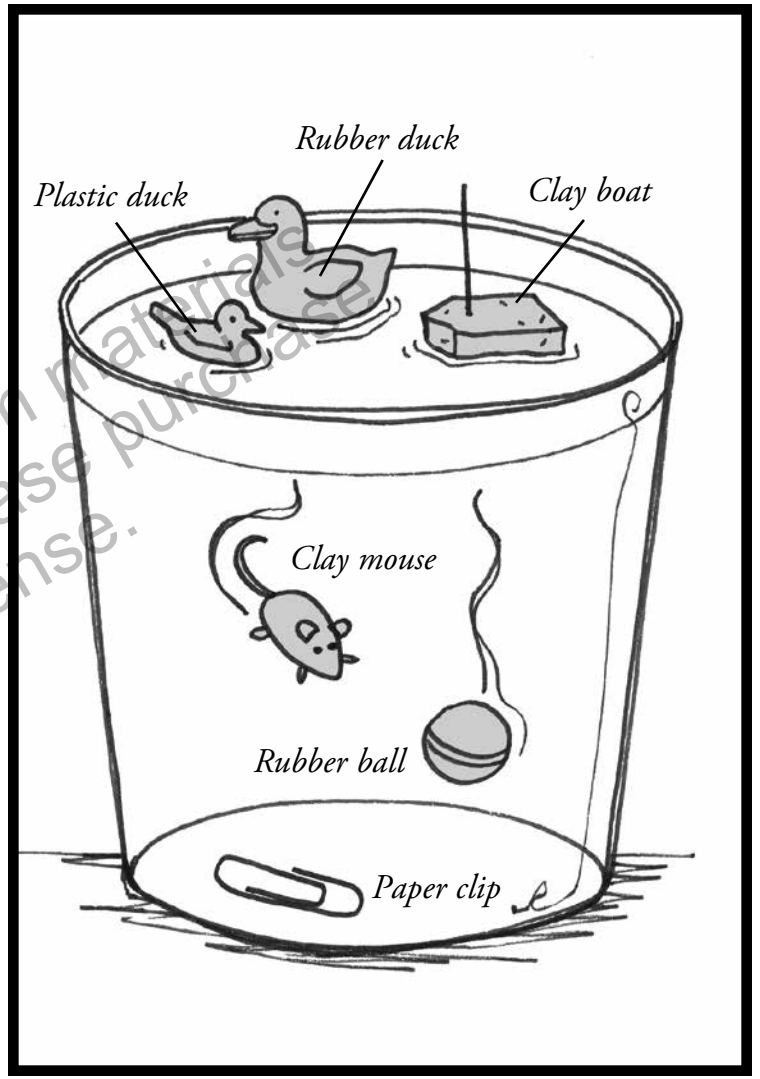
Students in a fourth grade class were curious about why some objects float and some sink. They had these questions:

- Do heavy objects always sink?
- Do light objects always float?

They designed an experiment. They filled a bucket with water and gathered objects to use in their experiment. The heavy objects they found were a clay mouse and a toy boat also made of clay. These objects had the same weight.

The light objects were a plastic duck and a paper clip. These objects had the same weight.

They also found a rubber duck and a rubber ball that were about the same weight. The picture on the next page shows the results of their experiment.



– Apply –
Think about other objects that might sink or float.
Do your own experiment at home or in the classroom.

Boat Design

If two objects have the same weight, the force of gravity is the same. So, why do the objects behave differently in water? It is because of their shape.

When an object is spread out on the surface of the water, the force of buoyancy is stronger, which helps the object float. If an object's shape is **dense**, like a ball, the force of buoyancy is less. This means that object is likely to sink.

When people want to travel on water, they need to build something that floats. Think about boats, canoes, and rafts. The shape of these objects helps them float. They float so well they can carry many people.

– Explain –
Look back at the experiment on page 15. Explain to a partner why each object sank or floated.

dense: balled up or compacted

This cargo ship is very heavy, but it floats because its shape displaces the water. But, the cargo ship cannot be overfilled. If it is, the force of gravity will be stronger and it will sink.

CHAPTER 3

Mix It Up

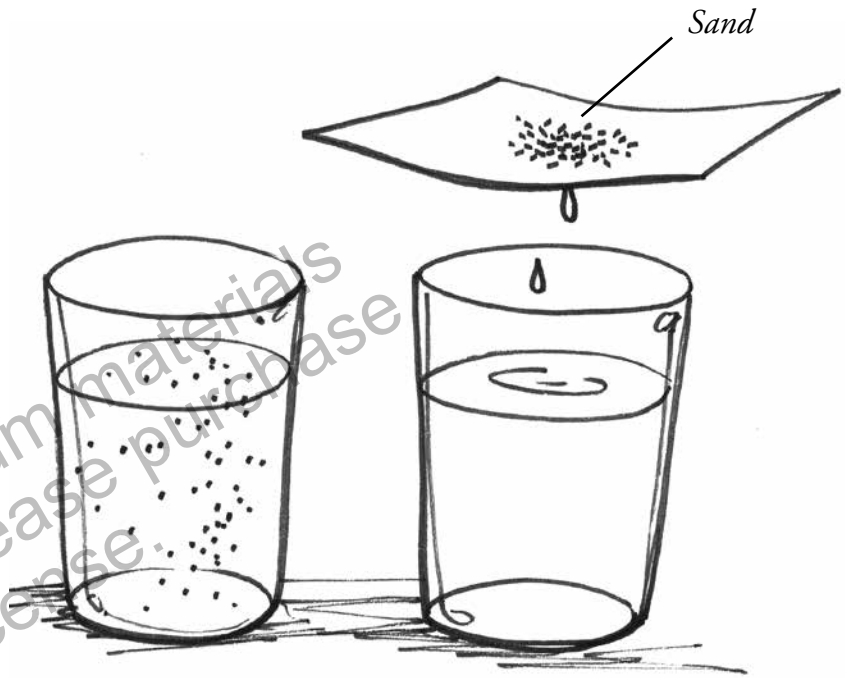
Not everything you put in water floats or sinks. Some things mix with water. You have probably seen mixtures in everyday life.

Mixtures

Salad dressings are good examples of mixtures. They often are made of water, oil, vinegar, and spices. When salad dressing is shaken up it looks cloudy. Over time the spices sink and the oil floats. Then you can see that salad dressing is really a mixture of things. Try it yourself at home.

Sand in water is an example of a mixture. When you stir sand into water, it is a cloudy mixture. But, if you pour the mixture through a fine screen the sand gets stuck in the screen and the water pours through.

– Extend –
Find examples of other mixtures in everyday life.



Sand mixed with water *Filtered water*

One important thing about mixtures is that they can be separated.

Solutions

A solution is a special type of mixture that is often not easily separated. Imagine that you put a drop of food coloring in water. What happens? The food coloring mixes with the water. If you stir it, all the water takes on the color of the food coloring.

What would happen if you let the water sit for a while? Nothing would happen. The water would still have the color of the food coloring.

What would happen if you poured the water through a sieve? Nothing would change. The water would still have the color of the food coloring.

– Extend –
Find examples of other solutions in everyday life.

solutions: mixtures that are not easily separated

Saltwater is another example of a solution. Unlike the food coloring, you can't see salt in water. But, you know it is there because the water tastes salty. Salt is hard
to get out of water. You can't just filter it out. You have to boil and evaporate the water away.

The next time you take a bath or go swimming, think about the properties of water.

- Is the water a solid, liquid, or gas?
- Would soap mixed with water be a solution or a mixture?
- What objects float in water?
- What objects sink in water?

If you make careful observations, you may discover even more things about water.

Glossary

buoyancy—the upward force that causes objects to float

dense—balled up or compacted

displaced—moved out of the way

gravity—the downward force that pulls objects toward the Earth

liquid—a state of matter that has a definite volume but no definite shape

mass—the amount of matter in an object

natural resource—a valuable substance found on Earth that is useful to humans

observe—to study carefully

observations—things discovered through careful study

odorless—to have no smell

shape—an object's form

solutions—mixtures that are not easily separated

volume—a measure of the amount of space an object takes up

To Find Out More . . .

Want to learn more about water?

Try these books

The Magic School Bus Ups And Downs: A Book About Floating And Sinking by Joanna Cole and Bruce Degan. Scholastic, 1997.

Eyewitness: Boat by Eric Kentley. DK Children, 2000.

Access these Web sites

U.S. Geological Survey's Water Science for Kids
http://ga.water.usgs.gov/edu/

The Regional Water Authority for Kids
http://www.rwah2o.org/rwa/educated/forkids/water/

Write for more information

U.S. Geological Survey National Center
12201 Sunrise Valley Drive
Reston, VA 20192

U.S. Environmental Protection Agency
Office of Water (4101M)
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

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Earth Science

Water

On Level

Assessments

Physical Properties of Water

Physical Properties of Water

Check Understanding

Shade the circle next to the correct answer.

1. Which tool might a scientist use to measure exactly 15 milliliters of water?

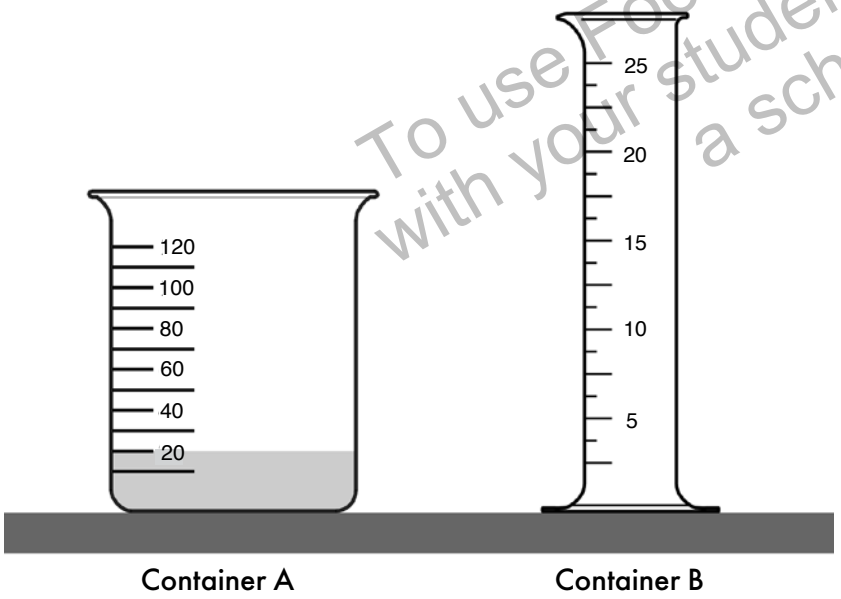
   Ⓐ graduated cylinder

   Ⓑ ruler

   Ⓒ measuring cup

   Ⓓ thermometer

The diagram below shows two measuring containers, A and B. Use this diagram to answer questions 2, 3, and 4.



2. Container A contains 20 milliliters (mL) of water. All of the water from container A is poured into container B. Shade container B in the diagram to show the volume of the water after it was poured from container A.

Note that question 3 has only three choices.

3. When all of the water from container A is poured into container B, what will happen to the volume of water?

   Ⓐ It will decrease.

   Ⓑ It will increase.

   Ⓒ It will stay the same.

4. If all the water from container A is poured into container B, which property of water will change?

   Ⓐ mass

   Ⓑ color

   Ⓒ shape

   Ⓓ state

Physical Properties of Water

Check Understanding

Shade the circle next to the correct answer.

5. What force causes a marble to sink to the bottom of a glass of water?

   Ⓐ friction
   Ⓑ gravity
   Ⓒ buoyancy
   Ⓓ magnetism

6. If a student drops a rock into a glass of water, what will happen to the water level?

   Ⓐ It will decrease.
   Ⓑ It will shrink
   Ⓒ It will increase.
   Ⓓ It will stay the same.

7. A student has a ball of clay that sinks when placed in a pan of water.

   Which property should he change to make the clay float?

   Ⓐ color
   Ⓑ texture
   Ⓒ mass
   Ⓓ shape

8. A student stirs sugar and water together. What happens?

   Ⓐ It forms a mixture that is easily separated.
   Ⓑ It forms a solution that is not easily separated.
   Ⓒ It forms a mixture when the sugar sinks to the bottom.
   Ⓓ It forms a floatation when the sugar floats to the top.

Physical Properties of Water

Assessment Scoring Guidelines

1. A
2. Container B should be shaded to show 20 mL of water.
3. C
4. C
5. B
6. C
7. D
8. B

Earth Science

Water

On Level

English Language Arts Activities

Physical Properties of Water

Summarize

Summarizing means retelling what you have read. Summaries are often shorter than the text you read. Summarizing helps you understand what you read.

Read this paragraph from *Physical Properties of Water* and try summarizing it.

Not all water is like the water that comes out of the faucet in your kitchen. There are other forms of water. For example, there is water in the ocean, water in mountain streams, water frozen in the polar ice caps, and water droplets in clouds.

Is this a good summary?

There is water in the ocean.

No! This statement is too specific and does not summarize the main idea. How about the one below.

Is it a good summary?

There are many forms of water.

Yes! This is the main idea of the paragraph.

TRY THE SKILL

Read the paragraphs. Shade the circle next to the best summary.

1. Shape is the form an object has. Water is a liquid, so it always takes the shape of its container. Try pouring water from a cup to a bowl. In the cup, the water is shaped like the cup, but in the bowl the water takes the shape of the bowl.

   Ⓐ Water is a liquid.

   Ⓑ Shape is the form an object has.

   Ⓒ Water can be shaped like a cup.

2. Volume is the amount of space an object takes up. If you pour water from one container to another, the volume does not change. You still have exactly the same amount.

   Ⓐ You still have the same amount of water.

   Ⓑ Volume is the amount of space an object takes up.

   Ⓒ You can pour water from one container to another.

Draw Conclusions

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

Here is a paragraph from *Physical Properties of Water*. The graphic organizer shows one conclusion you might draw, as well as the facts that support this conclusion.

Water can stop the force of gravity. Have you noticed that some objects like rocks sink when you drop them in water while other objects like boats float? This is because of buoyancy. Buoyancy is a force the pushes objects upward.

Conclusion Water can stop the force of gravity.
Facts • Some objects sink in water. • Some objects float in water. • Buoyancy is a force that pushes objects upward.

TRY THE SKILL

Read the passage from *Physical Properties of Water*.

Sand in water is an example of a mixture. When you stir sand into water, it is a cloudy mixture. But, if you pour the mixture through a fine screen the sand gets stuck in the screen and the water pours through.

Now complete this graphic.

Conclusion
Facts

Compare and Contrast

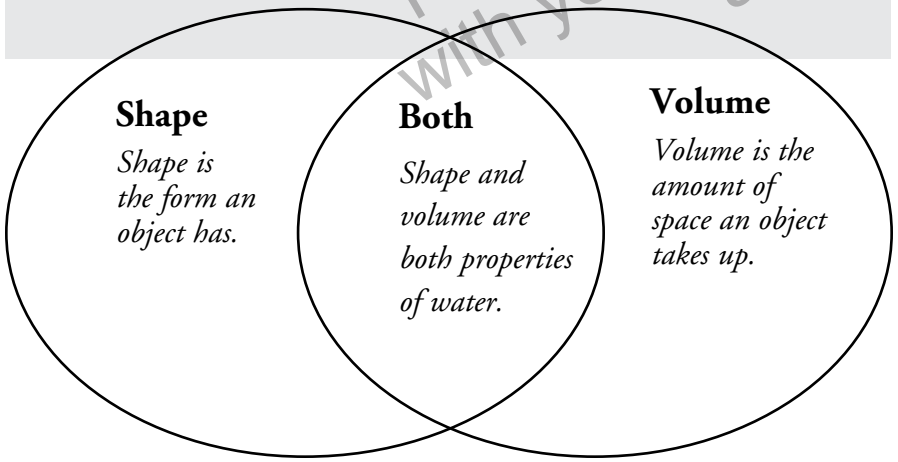
Comparing and contrasting can help you understand what you read.

- **Comparing tells how things are alike.**
- **Contrasting tells how things are different.**

Read these paragraphs. Then, read the Venn diagram that compares and contrasts.

Shape is the form an object has. Water is a liquid, so it always takes the shape of its container.

Volume is the amount of space an object takes up. If you pour water from one container to another, the volume does not change.

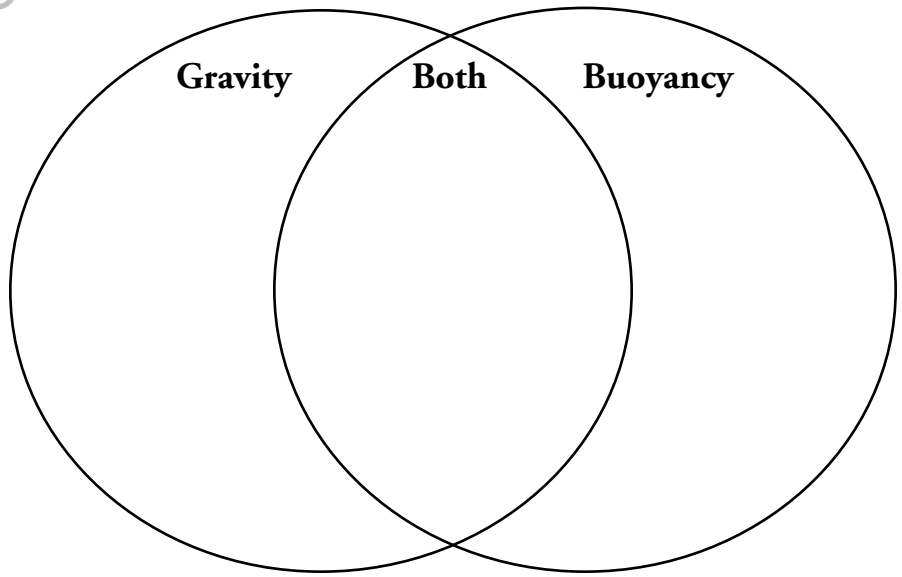


TRY THE SKILL

Read the paragraphs. Think about comparing and contrasting. Then complete the Venn diagram.

What goes up must come down. Why is this? Because of a force called gravity. Gravity pulls everything toward the Earth.

Water can stop the force of gravity. This is because of buoyancy. Buoyancy is a force the pushes objects upward.



Suffixes

Suffixes are short syllables at the end of a word that change the meaning of the word. Knowing suffixes can help you learn new words.

The suffixes *–tion* and *–sion* have the same sound and change a word in the same way. When you add *–tion* or *–sion* to the end of a verb it turns the verb into a noun.

Verb	Meaning
observe	To study closely

Verb + Suffix = Noun	Meaning
observation	What you discover when you study something closely

When you add *–sion* to *erode* it changes to a noun with a similar meaning.

Notice that when you add *–tion* or *–sion* to the end of a word, the spelling of the word changes slightly.

TRY THE SKILL

Here are some more words. Use what you know about the suffixes *–tion* and *–sion* to match the verbs with their related nouns.

Verb	Meaning
1. invent	To create something
2. move	To travel
3. expand	To get bigger
4. pollute	To soil or dirty something

Verb + Suffix = Noun	Meaning
A. motion	The act of traveling
B. pollution	The act of soiling or dirtying something
C. invention	The act of creating something
D. expansion	The act of getting bigger

1. _____ 2. _____ 3. _____ 4. _____

Answer Key

Summarize

1. B
2. B

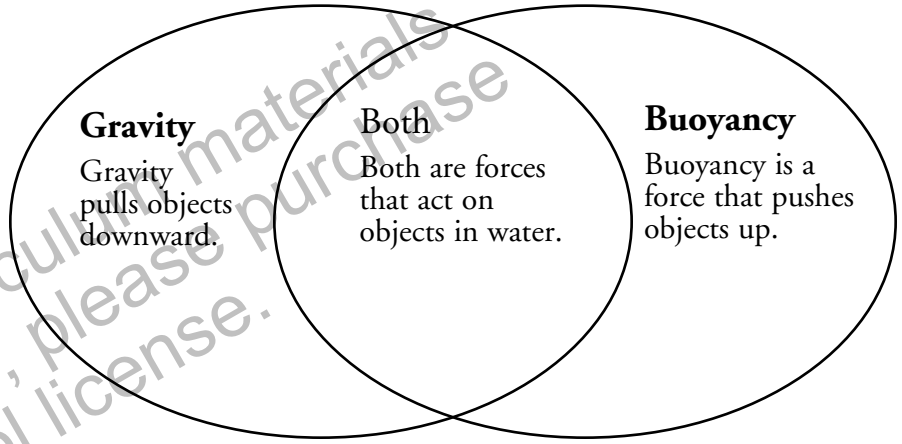
Draw Conclusions

Conclusion: Sand in water is a mixture.

Facts:

- When you stir the sand into the water, it is cloudy.
- If you pour the mixture through a fine screen the sand gets stuck in the screen and the water pours through.

Compare and Contrast



Suffixes

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