



Earth Science

Water

Basic Level

Physical Properties of Water

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Physical Properties of Water

What makes water so special?

NEW YORK STATE 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.

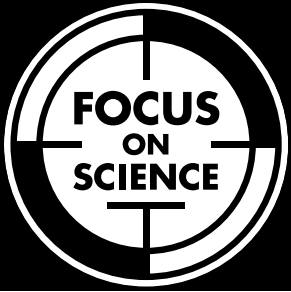
Measurements can be made with standard metric units and nonstandard units.

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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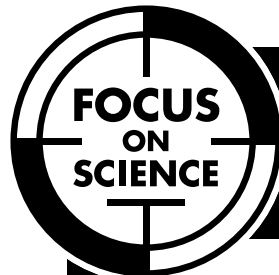
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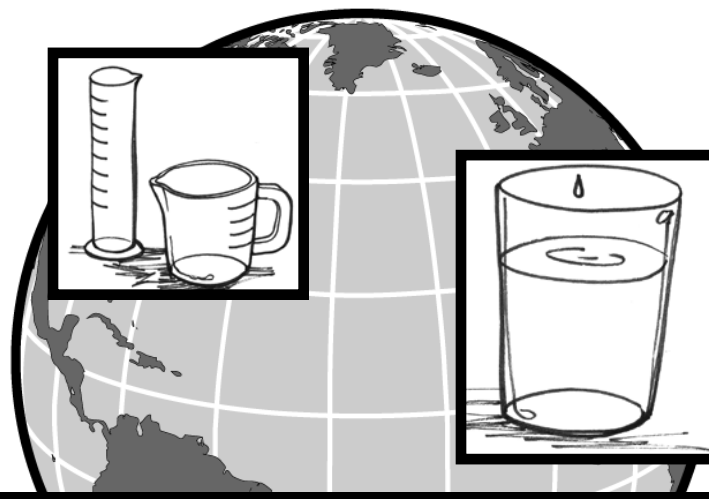


Earth Science

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Physical Properties of Water

by Caitlin Scott





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– Predict –

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

INTRODUCTION

Water Is Everywhere



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

It covers 70 percent of our planet. It makes up 65 percent of your body. It can turn to ice in winter. What is it? Water.

Some people think our planet was misnamed. We should not call it Earth. We should call it planet Water. All living things need water to survive. Understanding water helps us use this important **natural resource** wisely.

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

What Is Water?

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

Use Your Senses

Start with a glass of water. Use your eyes. What does water look like? It should be clear and colorless.

What shape does water have? It should be shaped just like the glass. Water always takes the shape of its container.

Use your nose. What does water smell like? Water should be **odorless**.

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

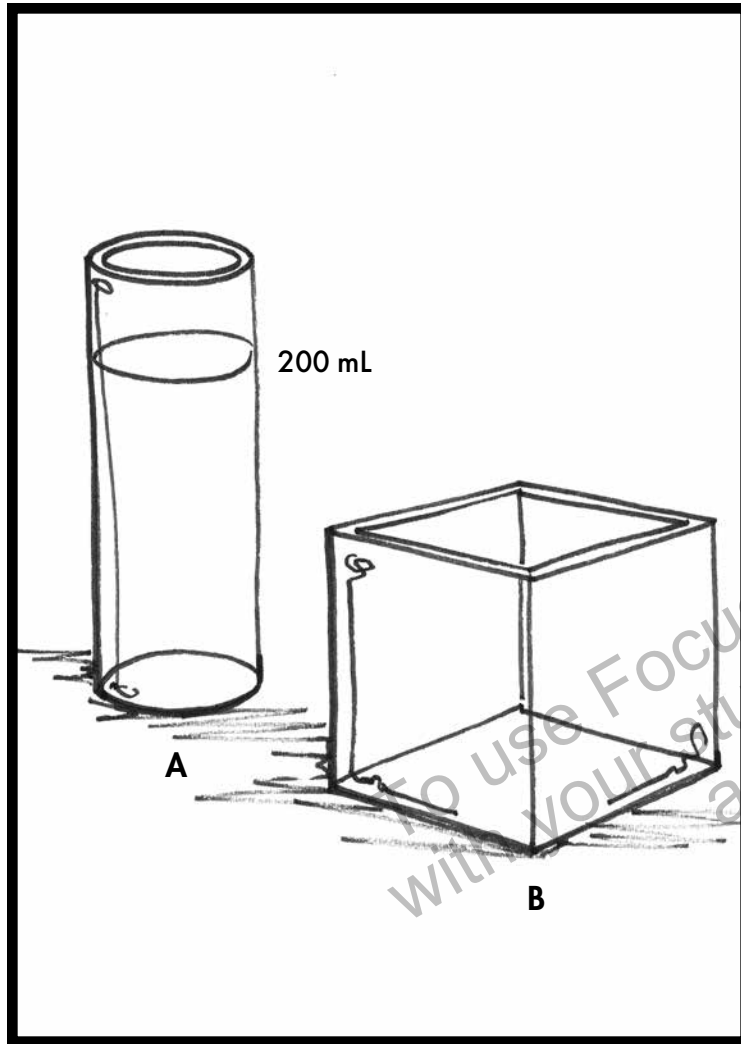
Use your tongue. What does water taste like? Water is mostly tasteless. Use your ears to listen to water. Water in a glass is silent.

But, not all water is like the water in a glass. There are other forms of water. There is water in oceans, water in mountain streams, water frozen in snow and ice, and water droplets in clouds.

Water takes three different forms: solid, **liquid**, or gas. In this book, you will learn 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 of an object. Water takes the shape of its container. Pour water from a cup to a bowl. In the cup, the water is shaped like the cup. In the bowl, the water takes the shape of the bowl.

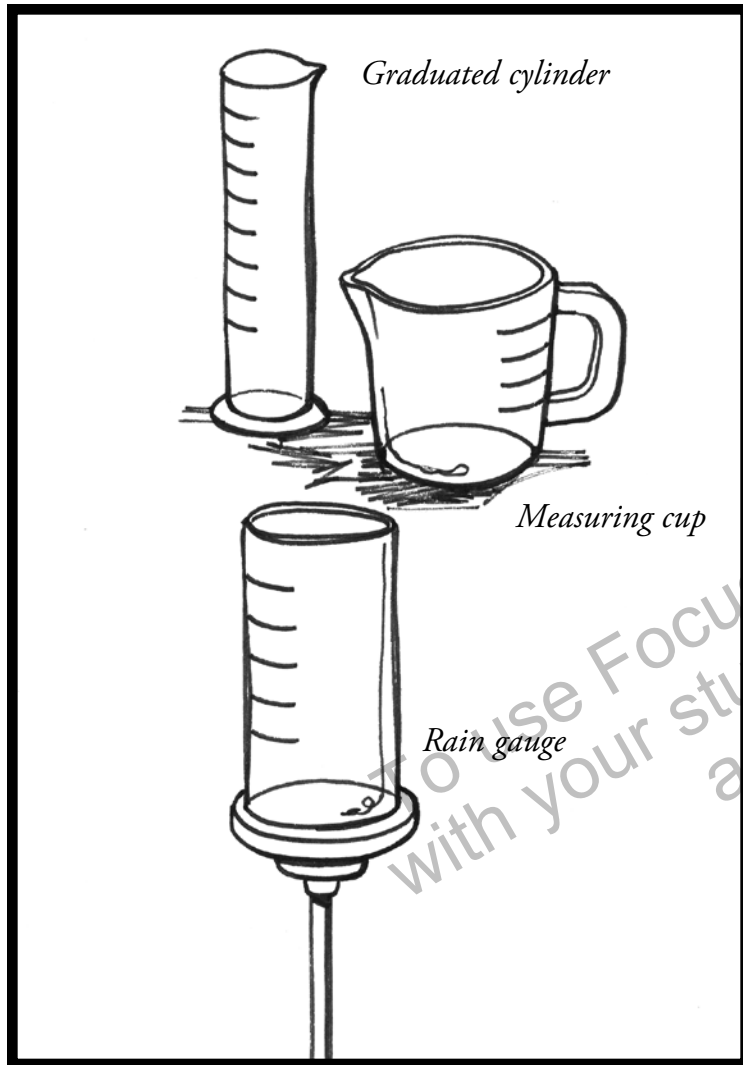
Volume is a measure of the amount of space an object takes up. If you pour the same amount of water from a cup to a bowl, the volume does not change. You have the same amount of water.

– 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 these. The cups measure the amount of water for a recipe.

Graduated cylinders: Many scientists use these. They measure the volume of water or other liquids for experiments.

Rain gauges: Meteorologists use these. They measure how much rain has fallen. Then, they record how much rain falls each day, each month, and each year.

Sink or Float?

What goes up must come down. Why?

Gravity pulls everything toward the Earth.

Water can stop the force of gravity. Some objects, like rocks, sink in water. Other objects, like boats, float. This is because of **buoyancy**. Buoyancy is a force that pushes objects upward.

When you get into the bathtub, the water rises. This is because the water is **displaced**. The water moves to make room for your body.

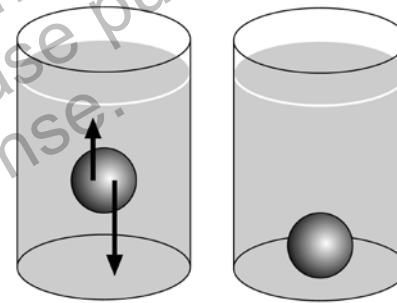
gravity: the downward force that pulls objects toward the Earth

buoyancy: the upward force that causes objects to float

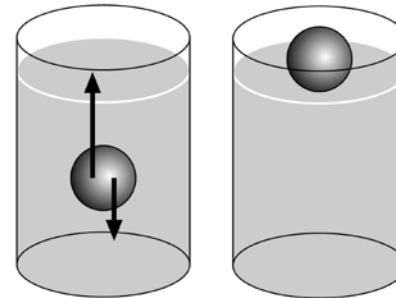
displaced: moved out of the way

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

In water, buoyancy and gravity work together. When gravity is stronger, objects sink. When buoyancy is stronger, they float.



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

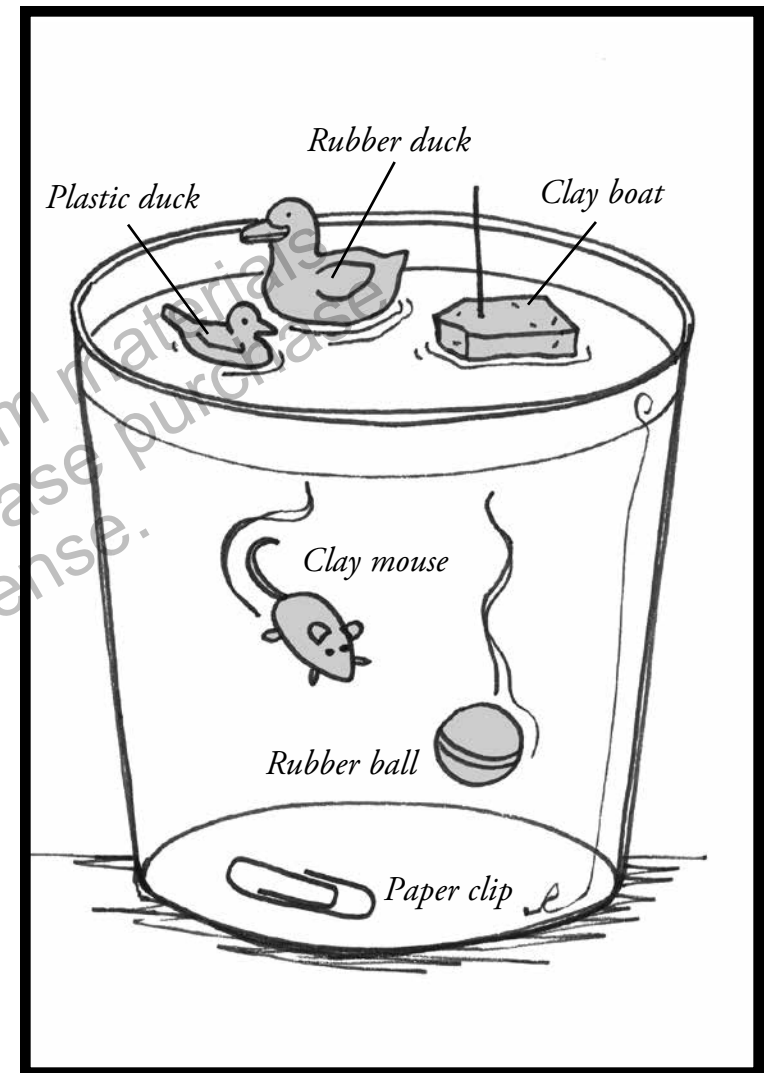
Students in a fourth grade class wanted to know why some objects float and some sink. They had these questions:

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

They filled a bucket with water. Then, they gathered objects for the experiment. The heavy objects were a clay mouse and a clay boat. They 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. They were about the same weight. The picture on the next page shows the results of the students' 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 two objects with the same weight behave differently in water? Because of shape.

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

Think about boats, canoes, and rafts. The shape of these objects helps them float.

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– Explain –

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

dense: balled up or compacted



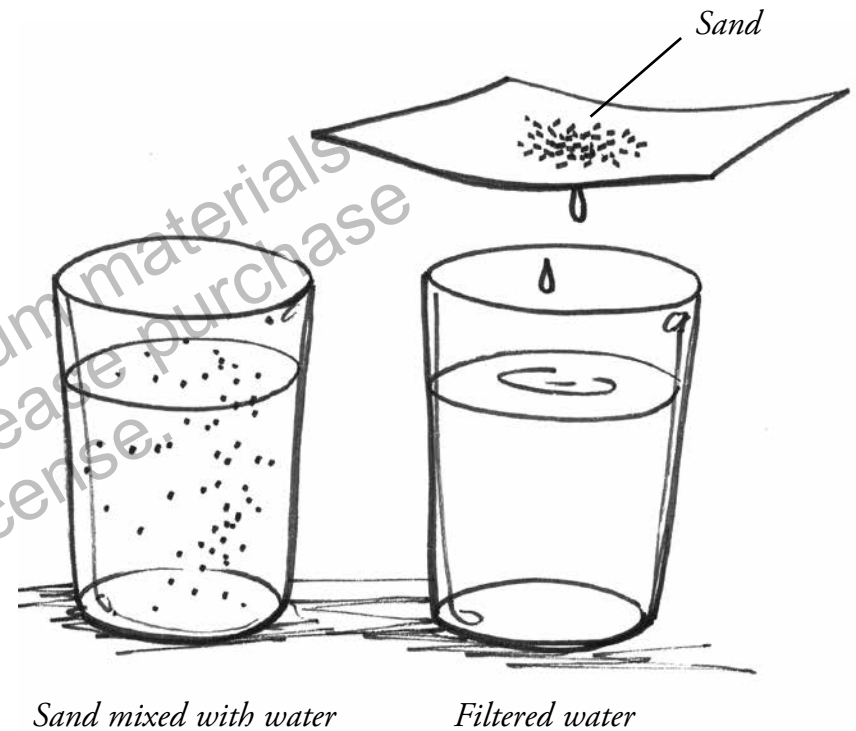
This cargo ship is very heavy, but it floats because its shape displaces the water. But, the cargo ship cannot be overfilled. If it is, the force of gravity will be stronger and it will sink.

Mix It Up

Mixtures

Some things mix with water. Salad dressings are mixtures. Many are made of water, oil, and spices. When salad dressing is shaken, it looks cloudy. Over time the spices sink and the oil floats. Then you can see that salad dressing is really a mixture.

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



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

– Extend –

Find examples of other mixtures in everyday life.

Solutions

A solution is a special kind of mixture that is often not easily separated. What would happen if you put a drop of food coloring in water? The food coloring would mix with the water in a special way. If you stirred, all the water would take on the color of the food coloring.

Imagine that you continued this experiment. What would happen if you let the water sit for a while? Unlike the salad dressing, it would not separate. The water would still have the color of the food coloring.

What would happen if you poured the water through a screen? Unlike the sand, food coloring cannot be filtered out of water. 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

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

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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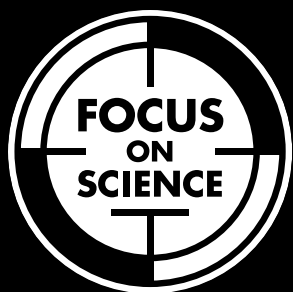
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Basic Level



Earth Science

Water

Assessments

Physical Properties of Water

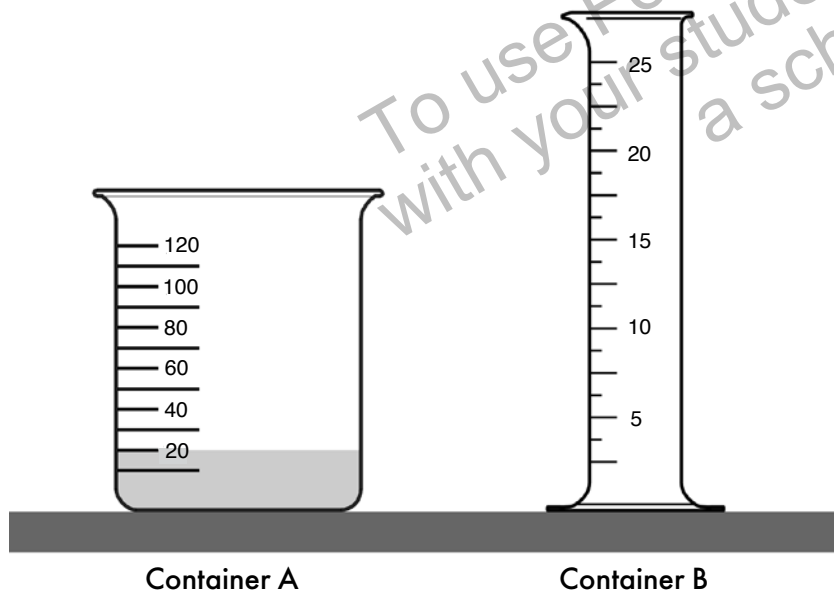
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Check Understanding

Shade the circle next to the correct answer or write your answer on the lines provided.

- Which tool should you use to measure milliliters of water?
 A graduated cylinder
 B ruler
 C thermometer
 D cup

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



Note that question 2 only has three choices.

- Container A contains 20 milliliters (mL) of water. If all the water from container A is poured into container B, how much water will be in container B?
 A 10 milliliters
 B 20 milliliters
 C 30 milliliters
- When all of the water from container A is poured into container B, does the volume of the water change? [1]

Circle one: Yes No

Explain your answer. [1]

Check Understanding

Shade the circle next to the correct answer or write your answer on the lines provided.

4. What force causes a boat to float on a lake?

- Ⓐ friction
- Ⓑ gravity
- Ⓒ buoyancy
- Ⓓ magnetism

5. If a student drops a rock into a glass of water, what will happen to the water level? [1]

6. Which is *not* a form water can take?

- Ⓐ buoyancy
- Ⓑ liquid
- Ⓒ solid
- Ⓓ gas

Note that questions 7 and 8 only have three choices.

7. A student has a ball of clay and wants to make it float in water. How should he shape the clay?

- Ⓐ in a tight ball
- Ⓑ in a perfect cube
- Ⓒ in a wide bowl

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

- Ⓐ The salt and water form a solution.
- Ⓑ The salt sinks to the bottom.
- Ⓒ The salt floats to the top.

Assessment Scoring Guidelines

1. A
2. B
3. No. The water changes shape but the volume stays the same.
4. C
5. The water level rises.
6. A
7. C
8. A

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Basic Level



Earth Science

Water

English Language Arts Activities

Physical Properties of Water

Main Idea

TRY THE SKILL

The main idea is the main point of what you read. Finding the main idea helps you understand what you read.

Read this paragraph from *Physical Properties of Water* and try to find the main idea.

Shape is the form of an object. Water is a liquid. It takes the shape of its container. Pour water from a cup to a bowl. In the cup, the water is shaped like the cup. In the bowl, the water takes the shape of the bowl.

Is this the main idea?

In the bowl, the water takes the shape of the bowl.

No! This statement is a detail about the main idea.

How about the one below. Is it the main idea?

Shape is the form of an object.

Yes! This is the main idea of the paragraph.

Read the paragraphs. Shade the circle next to the sentence that best describes the main idea.

1. Some things mix with water. Salad dressings are mixtures. Many are made of water, oil, and spices. When salad dressing is shaken, it looks cloudy. Over time the spices sink and the oil floats. Then you can see that salad dressing is really a mixture.
 - A Salad dressings look cloudy.
 - B Some things mix with water.
 - C Salad dressings are mixtures.
2. Sand in water is also a mixture. When you stir sand into the water, it is a cloudy mixture. But, if you pour the mixture through a fine screen, the sand gets stuck in the screen.
 - A Sand in water looks cloudy.
 - B The sand gets stuck in the screen.
 - C Sand in water is a mixture.

Antonyms

TRY THE SKILL

Antonyms are words that have opposite meanings. Some examples of antonyms are:

night and day
up and down
inside and outside
left and right

Read the paragraph. Look for antonyms.

Gravity pulls things down. It pulls more strongly on things that are heavy. It does not pull as strongly on things that are light.

***Heavy and light* are antonyms.**

1. Read the paragraph from *Physical Properties of Water*. Underline the antonyms.

What goes up must come down. Why? Gravity pulls everything toward the Earth. It pulls more strongly on objects that are heavier.

2. Read the paragraph from *Physical Properties of Water*. Underline the antonyms.

Water can stop the force of gravity. Some objects, like rocks, sink in water. Other objects, like boats, float.

3. Think of another pair of antonyms that have to do with water. Write the antonyms in the space below.

Use a Glossary

TRY THE SKILL

Glossaries are a list of difficult words used in a book. They tell the reader what these words mean.

Do you know what the word *observe* means?

Use the glossary on page 22 of *Physical Properties of Water* to check the meaning.

observe—to study carefully

Observe means to study something carefully. Can you use *observe* in a sentence? Here are some examples.

The scientists observe the properties of water to learn more about water.

The students will do an experiment and observe the results.

Match the words from *Physical Properties of Water* with their definitions. Use the glossary on page 22 if you need help.

Words

Meanings

1	buoyancy	A	the downward force that pulls objects toward the Earth
2	odorless	B	an object's form
3	displaced	C	a state of matter that has definite volume but no definite shape
4	shape	D	the upward force that causes objects to float
5	gravity	E	to have no smell
6	volume	F	a measure of the amount of space an object takes up
7	liquid	G	moved out of the way

Predict

TRY THE SKILL

To predict is to say what might happen. *Physical Properties of Water* contains many facts that help you predict.

Read this paragraph.

Saltwater is another solution. You can't see salt in water. But, you know it is there. The water tastes salty. Salt is hard to get out of water. You can't filter it out. You have to boil the water away.

What happens when salt is stirred into water?

Remember that saltwater is a solution. It is not easy to get salt out of water.

Sugar water is also a solution. Is it easy to remove sugar from water?

No. Remember that it is not easy to separate a solution.

Read the paragraph from *Physical Properties of Water*. Shade the circle next to the correct answer.

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

1. What will happen to a rock in water?
 (A) It will sink.
 (B) It will float.
2. What will happen to a boat in water?
 (A) It will sink.
 (B) It will float.
3. What will happen to a feather on water?
 (A) It will sink.
 (B) It will float.

Answer Key

Main Idea

1. B
2. C

Antonyms

1. up and down
2. sink and float
3. Antonyms will vary

Use a Glossary

1. D
2. E
3. G
4. B
5. A
6. F
7. C

Predict

1. A
2. B
3. B

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