FOCUS ON SCIENCE

Earth Science

Water

Advanced Level

Physical Properties of Water

LOOK INSIDE FOR:

- Core Curriculum Covered
- Student Book
- Assessments and Reading Activities

FOCUScurriculum

866-315-7880 • www.focuscurriculum.com

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.

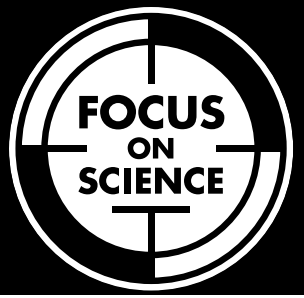
Measurements can be made with standard metric units and nonstandard units.

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.



Earth Science

Water

Advanced Level

Student Book

Physical Properties of Water

AL

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.

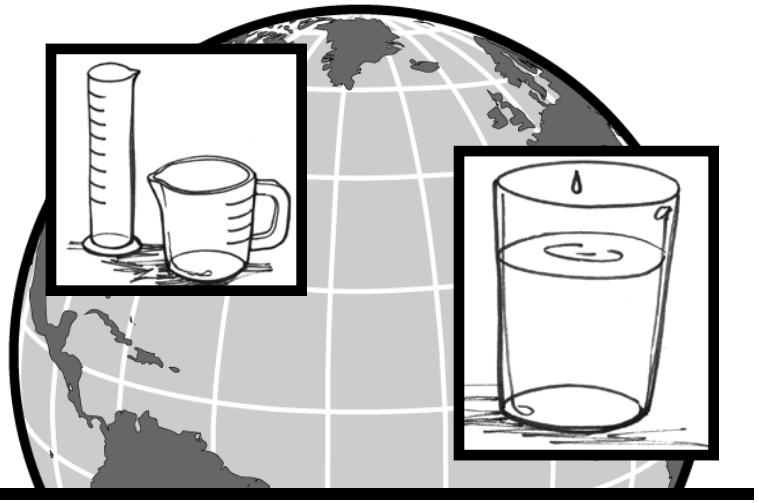
FOCUS ON SCIENCE

Earth Science

Water

Physical Properties of Water

by Caitlin Scott



FOCUS ON SCIENCE

Earth Science

Water

Physical Properties of Water

by Caitlin Scott

FOCUScurriculum

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 and makes up about 65 percent of your body. It is always changing its form. It can cover your house in a white blanket in winter or cool you off on a hot summer day. Every single plant, animal, and human being needs it in order to survive. What is this mysterious substance? It is ordinary, everyday water, also known as H_2O.

Some people think that our planet was misnamed. Instead of planet Earth, they think we should call our home planet Water. While water changes its form 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** wisely.

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

CHAPTER 1

What Is Water?

Scientists **observe** water in order to discover more about its properties. You can make **observations** about water, too by using your five senses.

Use Your Senses

Begin your water observations with a glass of ordinary tap water, and use your eyes to observe the water in the glass. What does water look like? It should appear clear and colorless.

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

Use your nose to make more observations. What does water smell like? Unless water has been mixed with something else, water should be **odorless**. In other words, it should have no smell.

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.

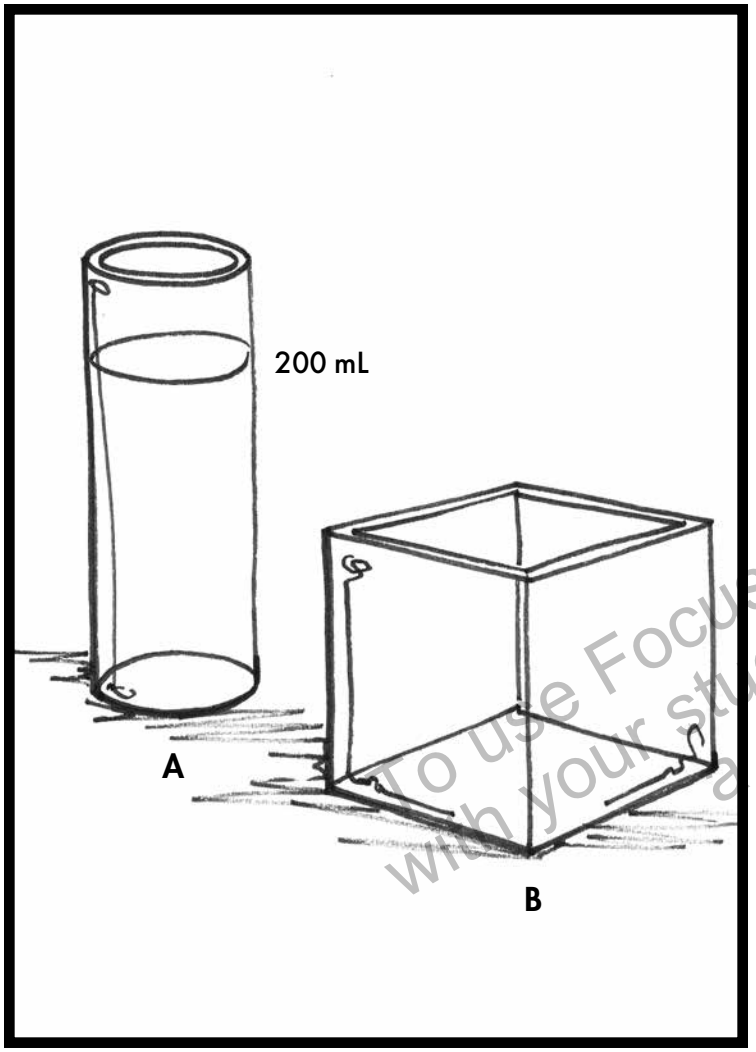
Finally, you can make observations using your ears, but you are not likely to hear much. Water in a glass is silent.

However, not all water is like the water that comes out of the faucet in your kitchen. There are other types of water on our planet. 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, we 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.

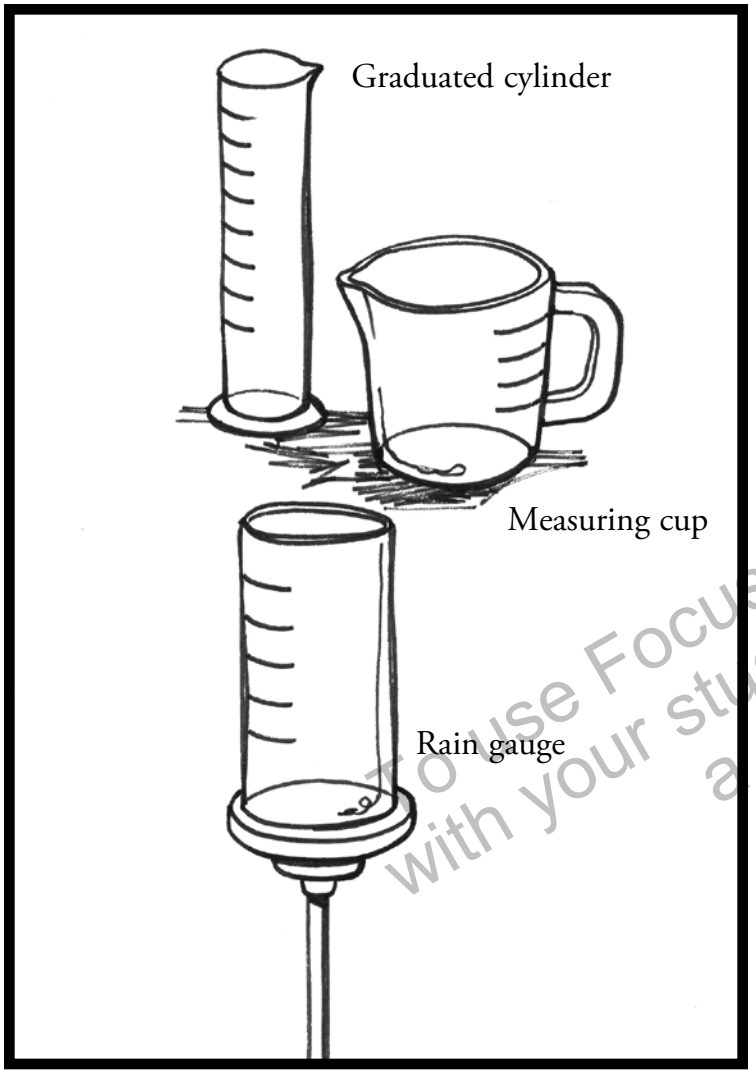
Shape and Volume

Shape is the form an object has. When water is in a liquid form, it always takes the shape of its container. To prove this fact, experiment with pouring water back and forth 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. To prove this fact, continue experimenting by pouring the same amount of water from container to container. Each time, use a measuring cup to measure the volume of the water. You will find that the volume is still exactly the same amount even if the containers are different shapes.

– 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

What are the best ways to measure the volume of water? People have invented different measurements for different purposes. Three different types of measurement tools are described below.

Measuring cups: Cooks often use measuring cups. These cups measure the amount of water for a recipe. Without measuring cups, it would be hard for cooks to get the same results each time they made the recipe.

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

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

CHAPTER 2

Sink or Float?

There's an old saying that "what goes up must come down." Why is this true? It is because of a force called **gravity**. Gravity pulls everything toward the Earth, but it pulls down more strongly on objects that have more **mass**.

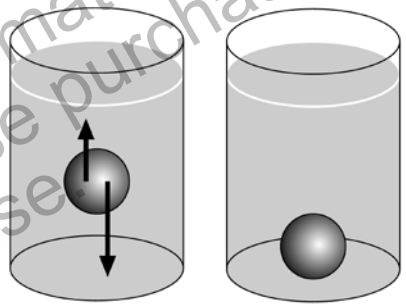
Water can counteract the force of gravity. Have you ever noticed that some objects, such as rocks, sink when you drop them in water while other objects, such as boats, float? This is because of a force called **buoyancy** that pushes objects upward. But what is it that makes buoyancy an upward force?

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 and pushes up on your body.

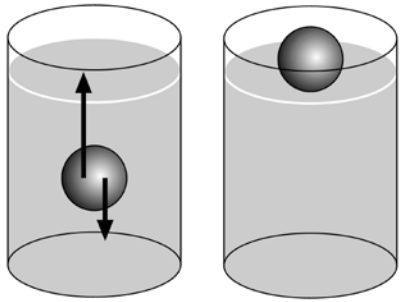
gravity: the downward force that pulls objects toward the Earth
mass: the amount of matter in an object
buoyancy: the upward force that causes objects to float
displaced: moved out of the way

Anytime water is displaced, the water level rises, creating an upward force called 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

Some students in a fourth grade class were curious about why some objects floated while other objects sank. They had the following questions:

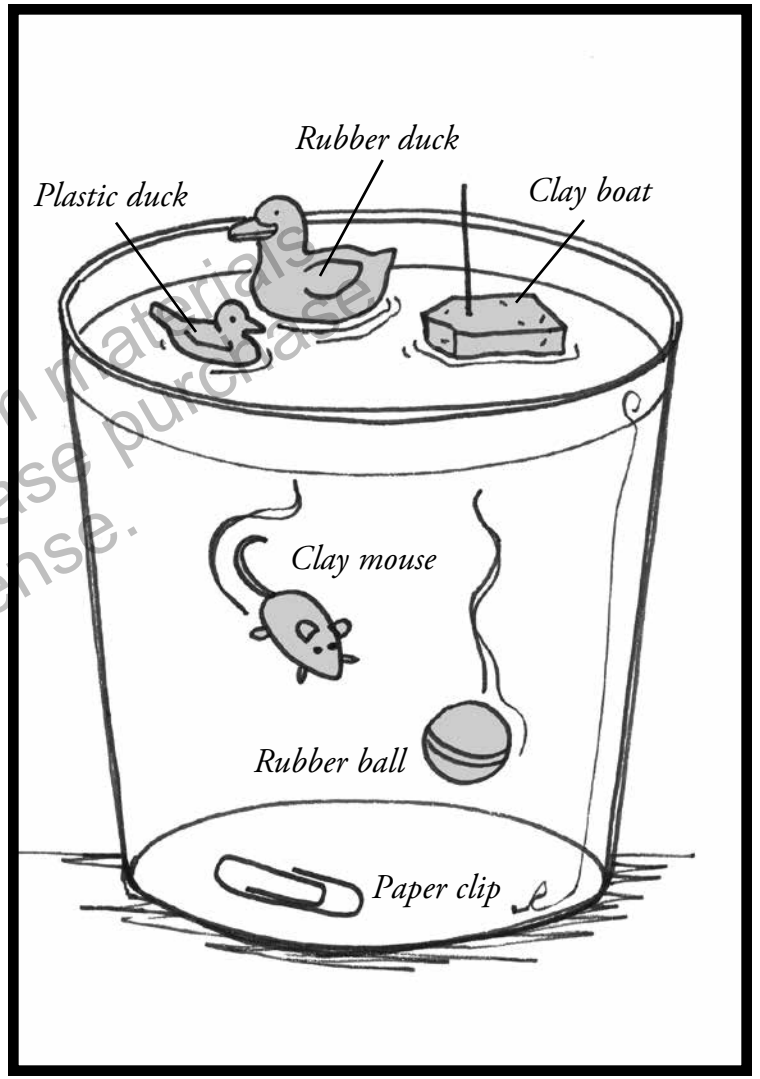
- Do heavy objects always sink?
- Do light objects always float?

To try to answer their questions, they conducted an experiment. First, they filled a bucket with water and gathered objects to use in the experiment.

The heavy objects they found were a clay mouse and a toy boat also made of clay. These objects had the exactly the same weight.

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

Finally, they also found a rubber duck and a rubber ball that were about the same weight. The illustration 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 mass, then the force of gravity is the same. So, why do two objects with the same mass behave differently when placed in water? They behave differently 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** or compacted, like a ball, the force of buoyancy is less. This means that a dense 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 so well that they can carry many people and heavy cargo.

– 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

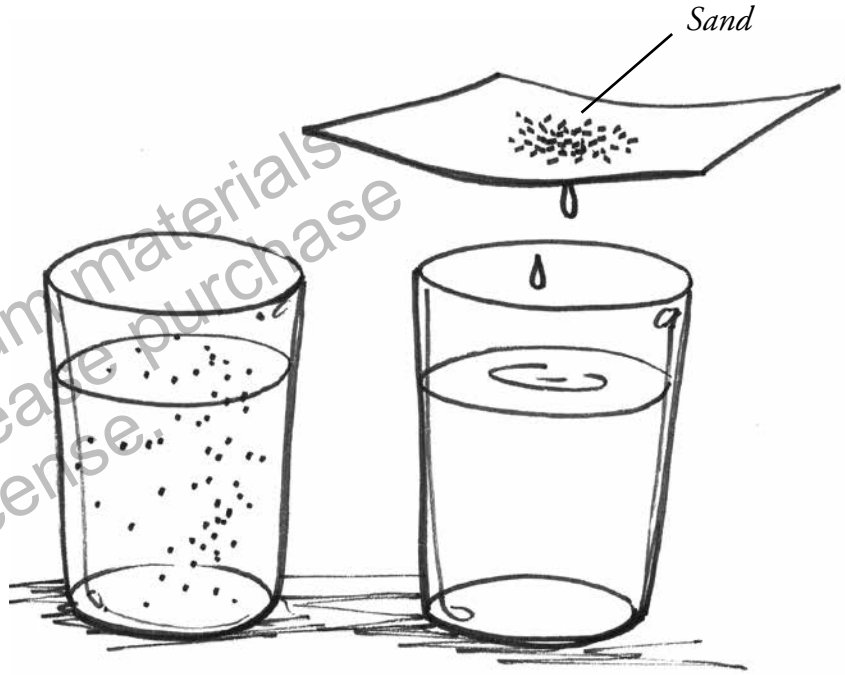
Mixtures

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

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 murky, but if you let it sit for a while, the spices sink and the oil floats. This proves that salad dressing is really a mixture of different things.

Sand in water is another example of a mixture. When you stir sand into the water, you create a cloudy mixture. However, if you pour the mixture through a fine screen, the sand gets stuck in the screen while 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 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

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

The next time you take a bath or go to a swimming pool or lake, 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

Index

Published by FOCUScurriculum

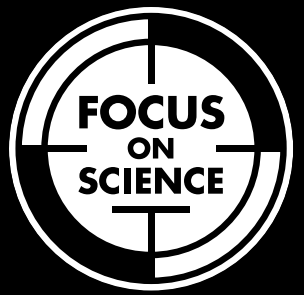
866-315-7880

www.focuscurriculum.com

Order Number: ES-22AL

Created by Kent Publishing Services, Inc.

Designed by Signature Design Group, Inc.



Earth Science

Water

Advanced Level

Assessments

Physical Properties of Water

Physical Properties of Water

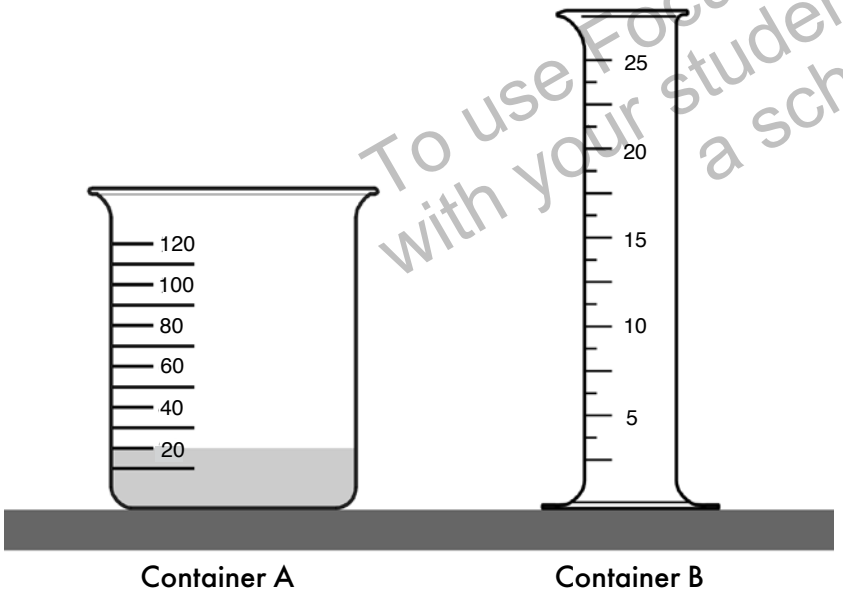
Check Understanding

Write your answer on the lines provided.

1. What tool might a scientist use to measure exactly 15 milliliters of water? [1]

_____

The diagram below shows two measuring containers, A and B. Use this diagram to answer questions 2 through 5.



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.

3. When all of the water from container A is poured into container B, what will happen to the volume of water? [1]

_____

_____

4. If all the water from container A is poured into container B, which property of water will change? [1]

_____

5. If half of the water from container A is poured into container B, how much water will be in each container? [1]

_____

Physical Properties of Water

Check Understanding

Write your answer on the lines provided.

6. What force causes a marble to sink to the bottom of a glass of water? [1]

_____

7. What force causes a boat to float on the ocean? [1]

_____

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

_____

9. A student has a ball of clay that sinks when placed in a pan of water. What can the student do to make the clay float? [1]

_____

_____

10. What is the difference between a mixture and a solution? [2]

_____

_____

_____

_____

Assessment Scoring Guidelines

1. A graduated cylinder
2. Container B should be shaded to show 20 mL of water.
3. It will stay the same
4. Shape
5. Both containers will have 10 mL of water.
6. Gravity
7. Buoyancy
8. It will rise.
9. The student should shape the clay into a boat or bowl shape.
10. A mixture is easily separated. A solution is not easily separated.

Earth Science

Water

Advanced Level

English Language Arts Activities

Physical Properties of Water

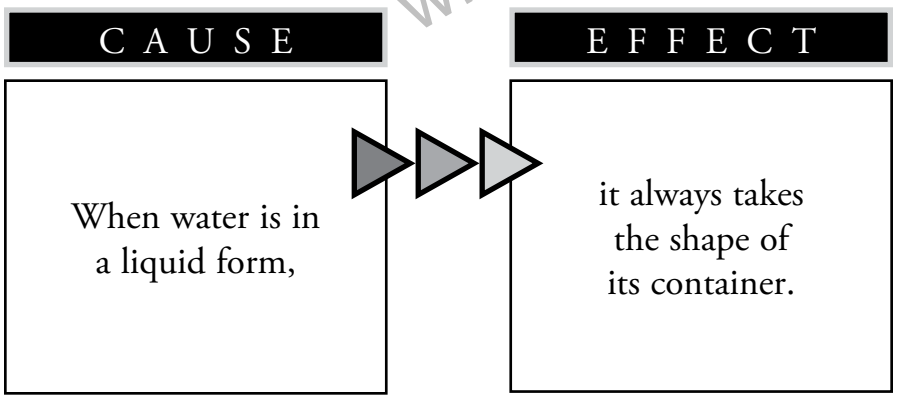
Cause and Effect

To find out an effect you ask, "What happened?" To find out a cause, you ask, "Why did that happen?" Identifying causes and effects is a way to understand what you read.

Read this passage from *Physical Properties of Water*.

When water is in a liquid form, it always takes the shape of its container. To prove this fact, experiment with pouring water back and forth 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.

This graphic explains what happened in the first sentence.



TRY THE SKILL

Read these sentences. Underline the cause and circle the effect.

1. When the force of gravity acts on a rock in water, the rock sinks.
2. As salt is stirred into water, it forms a solution.
3. Water should be shaped just like the glass you have poured it in because water always takes the shape of its container.
4. If you mix sand and water, it forms a mixture.
5. A boat floats because of the force of buoyancy.
6. When you pour water from one container to another, the volume doesn't change.

Write your own sentence showing cause and effect.

_____

_____

_____

_____

Main Idea and Supporting Details

The main idea is the writer's main point. Supporting details give more information about this main idea.

Here is a paragraph from *Physical Properties of Water*. The graphic organizer shows a main idea and supporting details.

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.

Main Idea

Whenever an object is placed in water, buoyancy and gravity work together.

Supporting Details

- When the force of gravity is stronger, an object sinks.
- When the force of buoyancy is stronger, an an object floats.

Can you think of other details that would support this main idea?

TRY THE SKILL

Read this passage from *Physical Properties of Water*. Then complete the graphic organizer

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

Main Idea

Supporting Details

Ask Questions

You can monitor your understanding of what you read by asking questions about the topic and then reading to find the answer. Sometimes authors will even write a question in the text and then answer it.

Read the paragraph from *Physical Properties of Water*.

There's an old saying that "what goes up must come down." Why is this true? It is because of a force called gravity. Gravity pulls everything toward the Earth, but it pulls down more strongly on objects that are heavier.

What is the question?

Why is the saying "what goes up must come down" true?

What is the answer?

It is because of a force called gravity. Gravity pulls everything toward the Earth, but it pulls down more strongly on objects that are heavier.

TRY THE SKILL

Often the author does not write a question for you. You need to think of questions as you read.

Read the paragraph from *Physical Properties of Water*.

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.

1. What question could you ask?

_____

_____

2. What is the answer?

_____

_____

_____

_____

Table of Contents

The table of contents tells the reader what information is in the book and what page number the reader can start reading on to find the information.

Read the beginning of this table of contents.

What page would you begin reading to find information about volume?

Page 6, because the subheading on page 6 is "Shape and Volume."

What chapter would you read to find information about buoyancy?

Chapter 2, because the heading "Sink or Float?" is contained in chapter 2.

TRY THE SKILL

Read the beginning of the table of contents again. Answer the questions.

1. **What page would you begin reading to find the introduction?**
   - Ⓐ page 5
   - Ⓑ page 14
   - Ⓒ page 17
2. **Which chapter would you read to find information about how boats are made?**
   - Ⓐ Introduction
   - Ⓑ Chapter 1
   - Ⓒ Chapter 2
3. **What page would you begin reading to find information on how to measure water volume?**
   - Ⓐ page 6
   - Ⓑ page 11
   - Ⓒ page 18
4. **Which two chapters DO NOT contain information about gravity?**
   - Ⓐ Introduction and Chapter 1
   - Ⓑ Introduction and Chapter 2
   - Ⓒ Chapter 1 and Chapter 2

Answer Key

Cause and Effect

1. [circle] When the force of gravity acts on a rock in water, [underline] the rock sinks.
2. [circle] As salt is stirred into water, [underline] it forms a solution.
3. [circle] Water should be shaped just like the glass you have poured it in [underline] because water always takes the shape of its container.
4. [circle] If you mix sand and water, [underline] it forms a mixture.
5. [circle] A boat floats [underline] because of the force of buoyancy.
6. [circle] When you pour water from one container to another, [underline] the volume doesn't change.

Main Idea and Supporting Details

Main Idea

Saltwater is another example of a solution.

Supporting Details

- Unlike the food coloring, you can't see salt in water.
- You know salt is in the water because the water tastes salty.
- You can't filter salt out of water.
- You have to boil water to separate it from salt.

Ask Questions

1. What happens when an object is placed in water?
2. When the force of gravity is stronger, an object sinks. When the force of buoyancy is stronger, an object floats.

Table of Contents

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