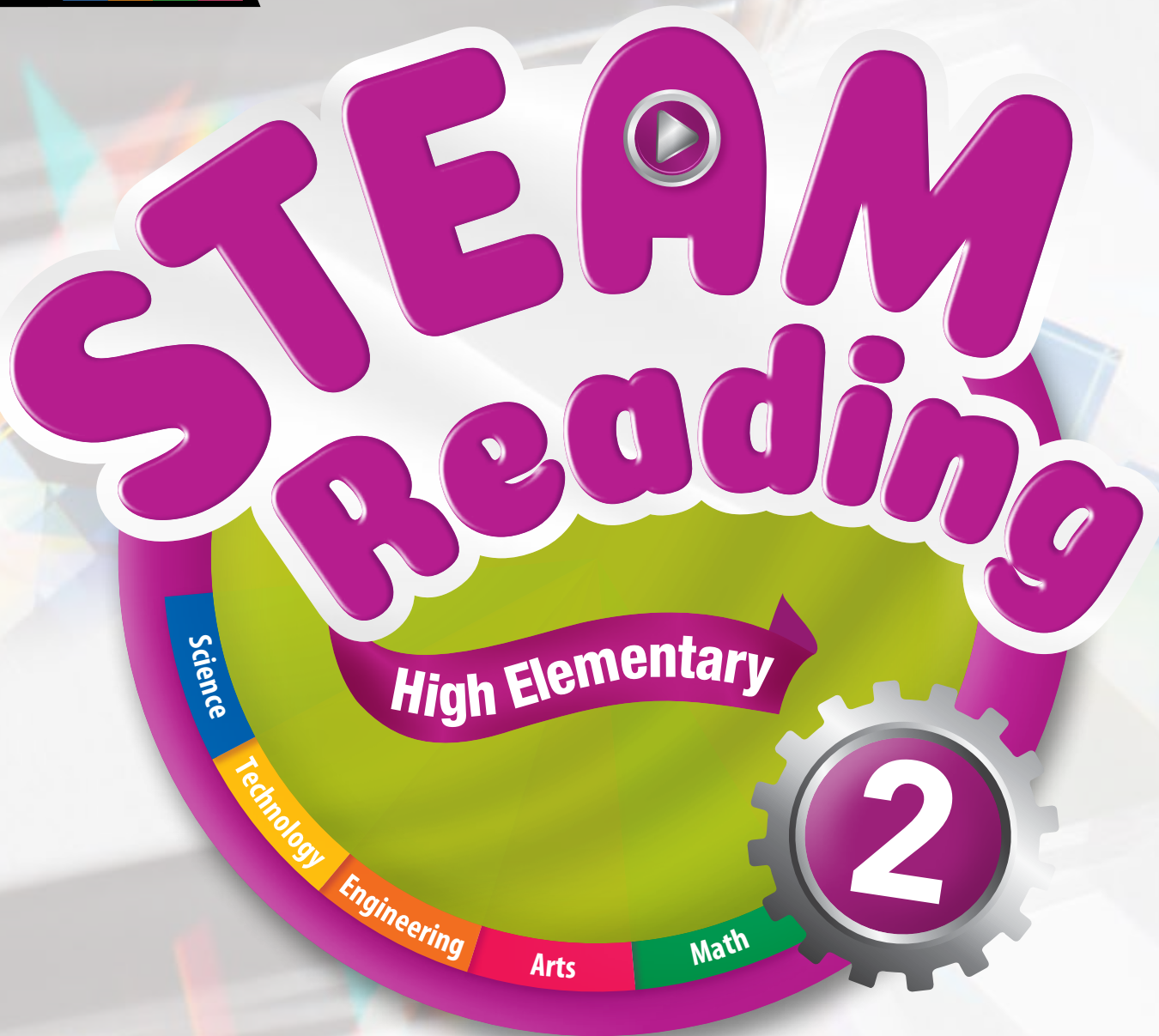




Matthew Broadhurst
Virginia Marconi

1

2

3

4

5



KEY WORDS

A Look, listen, and repeat. 19



n. electricity



adj. electrical



n. circuit



n. electric current



n. wire



v. connect



n. conductor



adj. complete

B Listen and number the words. 20

32

I will learn... about electricity and how it flows.

THE FLOW OF ELECTRICITY



WARM-UP

What happens when you plug in a lamp?



READING

Listen and read. 21

How does **electricity** flow? First, it needs an **electrical circuit**. The **electricity** flowing through the circuit is called an **electric current**.

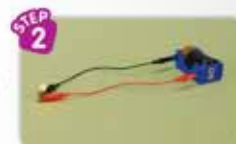
Can we make a circuit to turn on a light bulb? Prepare a battery, **wires**, and a light bulb.

Let's make two different circuits.

Circuit 1



Get two wires. **Connect** one end of each wire to each pole of the battery (+/-).



Connect the other ends of the wires to the light bulb. What happens?

1 STEAM

Units are grouped together in pairs. Each pair of units has lessons on the same subject. Every unit focuses on one or more aspects of STEAM (Science, Technology, Engineering, Arts, Math).

2 I WILL LEARN...

The academic objective of the unit is introduced to get students thinking.

3 QR CODES

Scan the audio QR CODE to listen to the key words and reading passages. In the experiment units, scan the video QR CODE to watch a video of a real experiment.



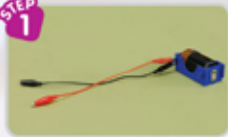
Video Experiments

Live-action videos take students step-by-step through all science experiments. This visual aid enhances their learning experience and makes the topic come alive.



Circuit 2

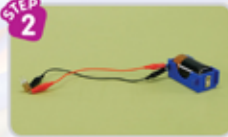
STEP 1



Get two wires. Connect one end of two wires to one pole of the battery.



STEP 2



Connect the other ends of the wires to the bulb. What happens?

When did the bulb light up? It only turned on in Circuit 1.

Why do you think that was?

An electrical circuit needs certain things.

1. The battery, wires, and bulb should all be connected.
2. The electrical **conductors** should be connected to both poles of the battery.
3. The light bulb should be connected to both conductors.

In Circuit 2, only one pole of the battery was connected.

The bulb didn't turn on because the electrical circuit wasn't **complete**.

The electricity couldn't flow.

Take the battery, wires, and light bulb again. What other circuits could you make with them?

6 Read and choose.

1. What does it mean in the reading?
a. the bulb b. the battery c. the wire
2. What does complete mean in the reading?
a. unfinished b. complicated c. finished

33

4 KEY WORDS

Every unit introduces new KEY WORDS that are necessary to understand the unit's topic. All key words are found in the READING and are illustrated with a photograph.

5 READING

Each READING is an introduction to the topic of the unit. The first unit in a pair introduces the subject through an experiment. The experiment is illustrated and easy to follow. The second unit features an engaging short story on the same topic.

6 SHORT ACTIVITIES

Short activities focus attention on the KEY WORDS and check understanding.

CHECK YOUR UNDERSTANDING

This section features a range of activities to check both reading comprehension and understanding of the unit vocabulary.

STEAM PROJECT

The STEAM PROJECT ends the unit with a fun and interactive project that encourages individual creativity as well as collaboration. Project types include experiments, math problems, and arts & crafts. Experimental projects have a video available via QR code. Further explanation for certain projects can be found in the PROJECT REFERENCE at the end of the book.

CHECK YOUR UNDERSTANDING

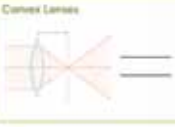
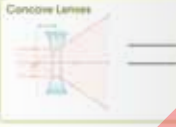
1 Choose the correct answers.

- What is the reading mainly about?
 - Why telescopes need an observatory
 - Why microscopes need concave lenses
 - Why telescopes need concave and convex lenses
- Convex lenses make things that are far away look _____.
 - bigger or closer
 - smaller and closer
 - smaller and further away
- Which of the following is **NOT** true about convex lenses?
 - They gather light.
 - Things seem closer.
 - Things seem smaller.

2 Circle T for true or F for false. Correct the false statements.

- Frank saw many cool telescopes at the laboratory. **T F**
- Concave lenses help us see small and far away things by making them look bigger and closer. **T F**

3 Complete the chart.

Convex Lenses	Concave Lenses
	
- They gather light from far away. - They make things look bigger and closer.	- They give a clearer image. - They spread light into your eyes.

4 Unscramble the letters and write them in the blanks.

- CONVEX** to bring things together
- CONCAVE** a tool to make small things look larger
- SPACE** the area beyond the atmosphere
- TELESCOPE** including every detail
- TELESCOPE** a building to watch the stars
- TELESCOPE** a tool with lenses to watch the stars

PROJECT USES OF LENSES

STEP 1 Match the words to the pictures.

Words	Pictures
telescopes	
cameras	
binoculars	
magnifying glass	
microscope	
periscope	

STEP 2 Match the words to the pictures.

see the pictures

see the pictures

WORDS WITH AN ASTERISK (*)

Difficult words in the unit are marked with an asterisk (*) and are explained in a word list at the back of the book.

PROJECT REFERENCE

1 CHANGING ARROWS

You can change the direction of an arrow by using refraction.

Materials:

-  a glass
-  water
-  an arrow drawn on paper

STEP

- Place the glass in front of the arrow. Make sure you can see the arrow clearly through the empty glass.
- Pour water into the glass slowly.

When light travels through a glass, it bends when entering the glass and water, and then it bends again when leaving the water and glass. Thus, the light paths cross and the image appears to be flipped horizontally.

2 THE REAPPEARING COIN

You can see a hidden coin using light refraction.

Materials:

-  a cup
-  a coin
-  water

STEP

- Place the coin inside the cup.
- Push the cup away from you until the wall of the cup hides the coin.
- Pour water into the cup.

In step 'b', the light reflecting off the coin does not reach the eyes. However, when you pour water into the cup, the light bends at the water's surface. Thus, light which was passing above the eyes refracts and now reaches the eyes. This makes the coin visible.

PROJECT REFERENCE

PROJECT REFERENCE pages go into further detail of the concepts behind the project.

WORKBOOK

VOCABULARY PRACTICE

This checks students' understanding of the key words introduced in the Student Book unit.

COMPREHENSION PRACTICE

These questions focus on a passage from the reading and check students' understanding of the text.

2 TALL BOY, SHORT LEGS

VOCABULARY PRACTICE

A Circle the correct words.

-  Because of refraction / instruction / reflection, objects appear different when you look at them through water.
-  You have to use your strength / brain / legs to solve this math problem.
-  The boy is drawing lines / pools / legs on the road using colorful chalk.
-  The children were swimming in the lawn / classroom / swimming pool because it was hot outside.

B Choose the correct words.

- Betty is our school champion. She can _____ from a 15-meter platform.
a. dive b. reflect c. walk
- It's _____ that Fred's wearing his left shoe on his right foot.
a. in advance b. late c. funny
- The _____ class passed the test, so their teacher is very happy.
a. part b. entire c. no one
- _____, please. Dr. White is waiting for you.
a. Come in b. Open the window c. Go out

COMPREHENSION PRACTICE

Read the following passage and choose the correct answers.

① Amy said, "It's because of light (a) _____. Light goes into the water and slows down. It changes (b) _____." ② "The light from the sun bounces off your legs in the water. Our brain only sees light as a straight line. It doesn't know the light has been refracted. So your legs look curved and strange." ③

- Find the words that best fit in the blanks.
a. (a) refraction (b) density
b. (a) energy (b) direction
c. (a) refraction (b) direction
- What is the best place for the sentence below?
"Why does that make my legs look strange?"
a. ① b. ② c. ③
- What does it mean in the passage?
a. sun b. light c. brain

SUMMARY

Complete the summary. One word is not used.

brains come in curved dive funny refraction swimming pool tallest

Rick, Ted, and Amy went to the 1. _____ because it was very hot. When they arrived, Rick was the first to 2. _____ into the water. He looked at his legs and was surprised. They looked really 3. _____. Rick was the 4. _____ boy in the entire school. But his legs looked short and wide. Amy explained that this was because of light 5. _____. She said that as light goes into the water, it slows down and changes direction. Our 6. _____ don't understand this. This is why Rick's legs looked 7. _____ and shorter than they really were.

SUMMARY

This is a recap of the unit's reading passage. Students are able to check their understanding of the ideas introduced in the unit.

TABLE OF CONTENTS

UNIT / PAGE	STEAM	DETAILS	
1 Page 8	S T E A M	Title	BROKEN CHOPSTICK / WC: 171 ▶
		Academic Objective	Learn about light refraction
		Vocabulary	lawn, pass, slow down, enter, refract, slightly, position, focused
		STEAM Project	Changing Arrows ▶ 21st Century Skills: Critical Thinking, Communication, Creativity
2 Page 12	S T E A M	Title	TALL BOY, SHORT LEGS / WC: 158
		Academic Objective	Learn more about light refraction
		Vocabulary	entire, swimming pool, dive, funny, refraction, brain, line, come in
		STEAM Project	The Reappearing Coin ▶ 21st Century Skills: Critical Thinking
3 Page 16	S T E A M	Title	PRESSURE CHANGES, VOLUME CHANGES / WC: 176 ▶
		Academic Objective	Learn about the volume changes of gases
		Vocabulary	certain, apply, plunger, lightly, change, repeat, base on, no matter
		STEAM Project	Fountain Bottle Experiment ▶ 21st Century Skills: Critical Thinking
4 Page 20	S T E A M	Title	A BAG OF CHIPS / WC: 168
		Academic Objective	Learn more about air pressure
		Vocabulary	pack, chip, in case, proud, swell, burst, inflated, suspicious
		STEAM Project	Atmospheric Pressure and Altitude 21st Century Skills: Critical Thinking
5 Page 24	S T E A M	Title	TWO DIFFERENT LENSES / WC: 174 ▶
		Academic Objective	Learn about different types of lenses
		Vocabulary	lens, bend, convex, concave, on the other hand, transparent, laser pointer, beam
		STEAM Project	What Can a Magnifying Glass Do? 21st Century Skills: Critical Thinking, Collaboration
6 Page 28	S T E A M	Title	TELESCOPES, MICROSCOPES, AND MORE! / WC: 160
		Academic Objective	Learn more about lenses and how they are used
		Vocabulary	observatory, space, telescope, explain, gather, in detail, binoculars, microscope
		STEAM Project	Uses of Lenses 21st Century Skills: Critical Thinking
7 Page 32	S T E A M	Title	THE FLOW OF ELECTRICITY / WC: 145 ▶
		Academic Objective	Learn about electricity and how it flows
		Vocabulary	electricity, electrical, circuit, electric current, wire, connect, conductor, complete
		STEAM Project	An Electrical Circuit 21st Century Skills: Critical Thinking
8 Page 36	S T E A M	Title	ALL OF THE LIGHTS / WC: 154
		Academic Objective	Learn more about how electricity flows
		Vocabulary	get ready, thread, light up, join, conduct, positive, negative, already
		STEAM Project	Electrical Conductors and Insulators 21st Century Skills: Critical Thinking

UNIT / PAGE	STEAM	DETAILS	
9 Page 40	S T E A M	Title	MORE BATTERIES / WC: 133 ▶
		Academic Objective	Learn more about electrical circuits and batteries
		Vocabulary	series, connection, parallel, remaining, brightness, voltage, strong, last
		STEAM Project	How Can We Make Holiday Lights? 21st Century Skills: Critical Thinking, Communication
10 Page 44	S T E A M	Title	ELECTRICITY EVERYWHERE / WC: 169
		Academic Objective	Learn more about things that use electricity
		Vocabulary	heater, run, plug, outlet, throw, grocery store, electronics, overheat
		STEAM Project	Why and How Should We Save Electricity? 21st Century Skills: Critical Thinking, Creativity, Communication
11 Page 48	S T E A M	Title	SEA BREEZE AND LAND BREEZE / WC: 181 ▶
		Academic Objective	Learn about the difference between a land breeze and a sea breeze
		Vocabulary	daytime, sea breeze, land breeze, lamp, heated, movement, heat up, create
		STEAM Project	Flowing Air 21st Century Skills: Critical Thinking
12 Page 52	S T E A M	Title	FLYING A KITE / WC: 172
		Academic Objective	Learn more about a land breeze and a sea breeze
		Vocabulary	take a trip, kite, above, from A to B, check out, dinner, go out, flow
		STEAM Project	Make a Kite ▶ 21st Century Skills: Creativity, Communication
13 Page 56	S T E A M	Title	THE HEIGHT OF THE SUN / WC: 156 ▶
		Academic Objective	Learn about the height of the sun and the seasons
		Vocabulary	differ, season, steep, angle, shallow, once, heat energy, rise
		STEAM Project	The Sun and The Seasons 21st Century Skills: Critical Thinking, Communication
14 Page 60	S T E A M	Title	THE LENGTH OF THE DAY / WC: 166
		Academic Objective	Learn about solar altitude
		Vocabulary	set, bright, solar altitude, during, at an angle, revolve, maximum, minimum
		STEAM Project	How to Read a Climate Graph 21st Century Skills: Critical Thinking
15 Page 64	S T E A M	Title	ELECTRICITY FROM THE SUN / WC: 159
		Academic Objective	Learn about changing sunlight into electricity
		Vocabulary	imagine, coal, climate change, solar, effective, plan, implement, essential
		STEAM Project	How Solar Panels Work 21st Century Skills: Critical Thinking, Communication
16 Page 68	S T E A M	Title	WEB DEVELOPER / WC: 158
		Academic Objective	Learn about developing a website
		Vocabulary	website, crash, manage, scroll, sell out, annoying, technical, load
		STEAM Project	What Can You Do on the Internet? 21st Century Skills: Critical Thinking, Creativity, Communication



I will learn... about light refraction.

BROKEN CHOPSTICK



Scan for Audio

KEY WORDS

A Look, listen, and repeat. 01



n. lawn



v. pass



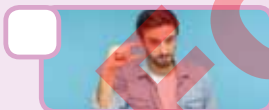
phr. slow down



v. enter



v. refract



adv. slightly



n. position



adj. focused

B Listen and number the words. 02

WARM-UP

What **does** it look like when you put a pencil in a glass of water?

READING

Listen and read. 03



Scan for Video

A car is driving along the road. What happens if it drives onto someone's **lawn**?

The speed of the car changes. The road and the lawn are made of different things. The car turns, too.

What about light? It's the same for light.

Light **passes** through many materials. They change its speed.

Water is denser than air. Because of this, light **slows down** when it **enters** water. It **refracts** the light. The light changes direction.

When we look at an object inside water, it looks different. Light refraction changes how it looks.

STEP 1



Prepare a solid cup and a chopstick.

STEP 2



Put the chopstick into the empty cup. You can see the straight chopstick.

STEP 3



Now, fill the cup with water and put in the chopstick. What does it look like now?

Did the chopstick look straight when it was inside the water?

No, it didn't. It looked bent. It looked like the chopstick was broken. The chopstick in the water also looked slightly wider.

Why is this? Light changed direction when it entered the water. When the light reflected from the chopstick hit our eyes, it looked like the chopstick was in a different position. Refracted light is focused. It makes things look bigger. So the chopstick looked wider, too.



c Read and choose.

1. Which is the opposite of slow down?

a. speed up

b. sit down

c. fall down

2. What does It mean in the reading?

a. the water

b. the air

c. the chopstick

CHECK YOUR UNDERSTANDING

A Choose the correct answers.

MAIN IDEA

1. What is the main purpose of the reading?
 - a. To explain how light reflects as it goes through air
 - b. To explain how light refracts as it goes through water
 - c. To explain how light doesn't change when it goes through water

DETAIL

2. The chopstick looks bent because _____.
 - a. refracted air looks bigger
 - b. refracted air changes its position
 - c. light changed direction when it entered water

DETAIL

3. Which of the following does light NOT do when it passes through water?
 - a. Refract
 - b. Boil
 - c. Slow down

B Circle T for true or F for false. Correct the false statements.

1. Light slows down when it enters air because it is denser than water.

T

F

2. When you put a chopstick in water, it looks bent and slightly narrower.

T

F

C Number the pictures in the correct order.



The chopstick looks broken and slightly wider.



Fill the cup with water.



Now, put the chopstick in the cup with water.



Put a chopstick into an empty cup. The chopstick is straight.

D Unscramble the letters and write them in the blanks.

1. **SPSA**
to move past something
2. **LWOS NODW**
to move slower than before
3. **RETNE**
to go into a place
4. **WNAL**
ground covered with grass
5. **YSIGHLTL**
only a little
6. **TRERFAC**
to change direction after hitting water



SCIENCE

TECHNOLOGY

ENGINEERING

ARTS

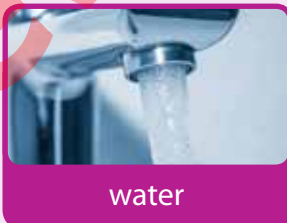
MATH

PROJECT CHANGING ARROWS

To do this experiment, you will need:



a glass



water



an arrow drawn
on paper



Scan for Video

STEP 1

Critical Thinking

- a. Place the glass in front of the arrow. Make sure you can see the arrow clearly through the empty glass.
- b. Pour water into the glass slowly.

Q. What happens?

A. The arrow **changes** / **doesn't change** direction.

STEP 2

Critical Thinking

Why does this happen?

Refraction is the bending of light as it **stays** / **passes** from one transparent substance into another. When light **enters** / **comes out of** the water in the glass, it bends. It bends again when it leaves the water and the glass. As a result, the light paths cross and the image appears to be flipped **horizontally** / **vertically**.

STEP 3

Critical Thinking

Communication

Creativity

Draw more arrows on paper and repeat the experiment with your friend. What do you see?

Go to page 74 to see the Project Reference.

STEAM Reading

High Elementary

Science

Technology

Engineering

Arts

Math

2

Workbook

Matthew Broadhurst
Virginia Marconi

TABLE OF CONTENTS

UNIT 1	BROKEN CHOPSTICK	4
UNIT 2	TALL BOY, SHORT LEGS	6
UNIT 3	PRESSURE CHANGES, VOLUME CHANGES	8
UNIT 4	A BAG OF CHIPS	10
UNIT 5	TWO DIFFERENT LENSES	12
UNIT 6	TELESCOPES, MICROSCOPES, AND MORE!	14
UNIT 7	THE FLOW OF ELECTRICITY	16
UNIT 8	ALL OF THE LIGHTS	18

UNIT 9	MORE BATTERIES	20
UNIT 10	ELECTRICITY EVERYWHERE	22
UNIT 11	SEA BREEZE AND LAND BREEZE	24
UNIT 12	FLYING A KITE	26
UNIT 13	THE HEIGHT OF THE SUN	28
UNIT 14	THE LENGTH OF THE DAY	30
UNIT 15	ELECTRICITY FROM THE SUN	32
UNIT 16	WEB DEVELOPER	34

VOCABULARY PRACTICE

A Match and write.

1.



enter

Grandmother takes good care of her _____ . It is really green and wonderful.

2.



refracts

This map shows you the _____ of some of these dams.

3.



lawn

Make sure you call Aunt Sally before you _____ her house.

4.



position

The pencils look funny because water _____ light.

B Choose the correct words.

1. We have to hurry, or we won't _____ through the airport security in time.

a. clear

b. pass

c. think

2. After her illness, Suzie was _____ thinner.

a. slightly

b. slowly

c. widely

3. You can light a fire from _____ light passing a magnifying glass.

a. tired

b. reflected

c. focused

4. Please _____ , or we'll have an accident.

a. steam up

b. bring in

c. slow down

COMPREHENSION PRACTICE

Read the following passage and choose the correct answers.

Why is this? Light changed direction when it entered the water. ① When the light reflected from the chopstick hit our eyes, it looked like the chopstick was in a different position. ② It makes things look bigger. ③ So the chopstick looked wider, too.

1. Why did it look like the chopstick was in a different position?
 - a. The chopstick looked wider.
 - b. The light changed direction when it entered the water.
 - c. The water changed direction when the chopstick hit it.

2. What is the best place for the sentence below?

Refracted light is focused.

- a. ①
 - b. ②
 - c. ③
3. What does position mean in the passage?
 - a. place
 - b. density
 - c. height

SUMMARY

Complete the summary. One word is not used.

drives enters light refracts slightly slows straight wider

When a car drives along a road and suddenly moves onto a lawn, its speed changes. The same happens with 1. _____. When light passes through different materials, it changes its speed. When it passes through water, light 2. _____ down because water is denser than air. When light 3. _____ water, the water 4. _____ the light, and it changes direction. In our experiment, we looked at a chopstick in an empty cup. It looked 5. _____. When we put water into the cup, the chopstick looked bent and 6. _____ wider. This is because light changed direction when it entered the water. When the light hit our eyes, it looked as if the chopstick was 7. _____ and in a different position, because refracted light is focused.