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Educated Solutions

Gateways to Science

STAAR Edition

Grade 6

Lesson 7: Elements and Their Symbols

Learning Goal

Identify an element and its symbol.

Engage

Materials

For each student
- calculator

Teacher Instruction

- Instruct students to complete the science notebook entry.

Engage

Page 47

Gold or Not?

While shopping for a new ring, you see a sign that reads—

Your mother doesn't think the sign is correct and doesn't think the ring is pure gold. In science class, you have been studying density, and you remember density is a physical property that can help determine the identity of different substances. The person selling the ring lets you measure the mass and the volume of the ring. You find out the mass is 42 g and the volume is 3 mL. The Internet tells you the density of the element gold is 19.3 g/mL. What can you conclude about the ring on sale? Is the ring pure gold? Explain your answer. *No, the ring is not pure gold. The calculated density is 14 g/mL. The density of pure gold is 19.3 g/mL, and the ring is much less. If the ring was pure gold, the density of the ring would be 19.3 g/mL.*

Facilitation Questions

- What method was used to find the volume of the ring? *The displacement method was used to find the volume of the ring.*
- What is a pure substance? *A pure substance is not mixed with any other substance.*
- What other properties can you use to describe pure gold? *Accept appropriate answers. Some answers might include solid, yellowish, metal.*

Materials

For student groups
- RM 14
- small, labeled resealable plastic bag
- large plastic resealable bag containing the following labeled items:
  - list of items found in the bag (*RM 14*)
  - piece of aluminum foil
  - iron nail
  - copper wire
  - zinc tack (can be purchased at a hardware store)
  - lead weight (can be purchased from the fishing department)
  - piece of sulfur (see note)
  - plastic spoon
  - paper towel
  - eraser
  - cotton ball
  - marker
  - plastic toy
  - golf ball
  - branch or twig
- chart paper
- markers

Explore

Advance Preparation

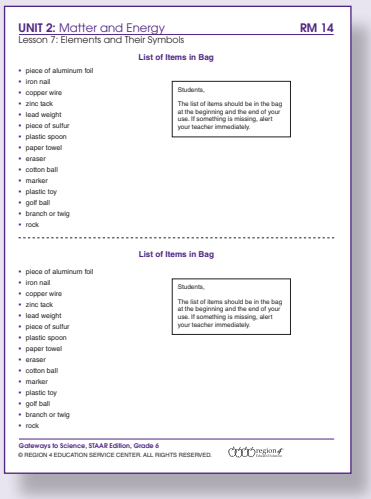
- Place sulfur in a small, labeled resealable plastic bag, such as a jewelry bag, before placing into the large resealable plastic bags.
- Prepare large resealable plastic bags with items listed on *RM 14: List of Items in Bag*.

Teacher Instruction

- Place students in groups of 2–3.
- Instruct students to complete the science notebook entry.
- Monitor student groups and redirect as needed.
- Display student charts so that students can move around the room and read other groups' charts during a gallery walk.
- Instruct students to leave their science notebooks at the table and move as a group to the next group's table to observe their classification and justification. Students should not write on their poster or make any changes.
- Allow students 1–2 minutes at each poster. Continue alerting students to move to the next group until they return to their original seat.

Teacher Note

Check with the school nurse to make sure no students are allergic to sulfur.


UNIT 2: Matter and Energy RM 14
Lesson 7: Elements and Their Symbols
List of Items in Bag
• piece of aluminum foil
• iron nail
• copper wire
• zinc tack
• lead weight
• piece of sulfur
• plastic spoon
• paper towel
• eraser
• cotton ball
• marker
• plastic toy
• golf ball
• branch or twig
• rock
Students,
The list of items should be in the bag at the beginning and the end of your use. If something is missing, alert your teacher immediately.
List of Items in Bag
• piece of aluminum foil
• iron nail
• copper wire
• zinc tack
• lead weight
• piece of sulfur
• plastic spoon
• paper towel
• eraser
• cotton ball
• marker
• plastic toy
• golf ball
• branch or twig
• rock
Students,
The list of items should be in the bag at the beginning and the end of your use. If something is missing, alert your teacher immediately.
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Explore

Page 48

Example or Nonexample?

- Copy the T-chart into your science notebook.
- Study the example and nonexample shown in the T-chart.

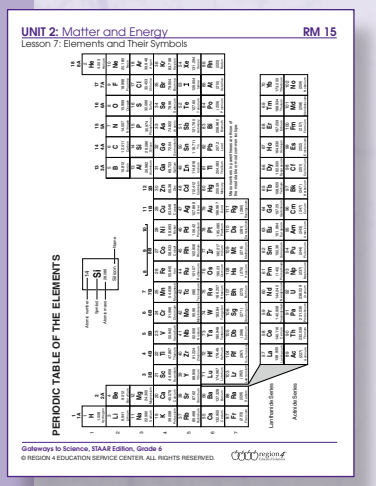
Example	Nonexample
gold	T-shirt
aluminum foil	*plastic spoon*
iron nail	*paper towel*
copper wire	*eraser*
zinc tack	*cotton ball*
lead weight	*branch or twig*
piece of sulfur	*golf ball*
	plastic toy
	marker
	rock

- Classify the objects provided by your teacher as an example or a nonexample.
- Record your classifications on the T-chart you created in your science notebook.
- Discuss with your group an explanation for the classification of the object examples versus nonexamples.
- Record the group's classification on the chart paper provided by your teacher.
- Once your group agrees on the classification table and the explanation, follow your teacher's directions to view other groups' classifications.

Materials

For each student
- RM 15

For student groups
- RM 16


UNIT 2: Matter and Energy RM 15
Lesson 7: Elements and Their Symbols
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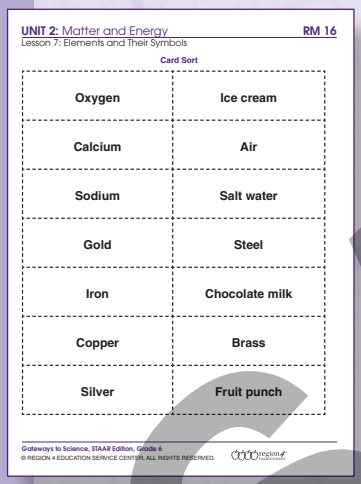
UNIT 2: Matter and Energy RM 16
Lesson 7: Elements and Their Symbols
Card Sort

Oxygen	Ice cream
Calcium	Air
Sodium	Salt water
Gold	Steel
Iron	Chocolate milk
Copper	Brass
Silver	Fruit punch

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Explain, Part 1

Teacher Instruction

- Solicit groups to present their classification poster and explain how they classified objects. Each group should present their poster.
- Debrief the Explore activity utilizing the posters and facilitation questions.
- Instruct students to read and discuss "Elements and Their Symbols."
- Students should discuss the questions in the passage and in their science notebooks, record their answers.
- Discuss student responses to the three questions.
- Instruct students to complete the science notebook entry using *RM 15: The Periodic Table*. Students do not need to memorize elements and their symbols but must be familiar with using the Periodic Table of the Elements to identify symbols and element names.
- Allow students to share responses with a partner before discussing the correct answers as a class.
- Instruct students to complete the "Elements and Their Symbols Summary" science notebook entry.
- Instruct students to revisit their explanation of examples and nonexamples from the Explore activity. Students should rewrite their explanation using the term *element*.

Explain, Part 1

Pages 48–50

- Preview the questions in "Elements and Their Symbols," then read and discuss the passage.
- With a partner, discuss the main ideas of each paragraph and your answers to the questions.

Elements and Their Symbols

Everything in the universe is either matter or energy. If something has mass and takes up space, it is matter. If it is able to make changes happen, it is energy. Energy does not have mass or volume.

Chemistry is the study of matter, its properties, and how it changes. Every kind of matter has a set of properties that help identify the matter.

For example, some properties are easily observable, such as color, shape, odor, and texture. Other properties, such as mass, volume, and temperature, can be measured using tools. Some properties cannot be observed or measured directly. Instead, they must be calculated. Density is one of those types of properties.

What are physical properties?

Physical properties such as density, color, shape, odor, texture, mass, volume, and temperature help identify matter.

The building blocks of matter are known as elements. An element is the simplest pure substance made of only one kind of atom and has definite properties. Over the centuries, scientists have worked to organize all the known elements of the universe into a specialized chart called the Periodic Table of the Elements.

What is an element?

An element is the simplest pure substance made up of only one kind of atom and has definite properties.

Chemical symbols are used to represent each element. The Periodic Table is used by scientists around the world. No matter what country you are in or what language is spoken, the language of chemistry is the same all over the world. The chemical symbol for each element is a shorthand method of writing the name.

Why do scientists use chemical symbols?

Chemical symbols are used to represent an element and are easily communicated to people around the world.

Writing Chemical Symbols

- The symbol always begins with a capital letter.
- If there is a second or third letter, it is written in lower case.
- Periods are not used at the end of the symbol.

Elements and Their Symbols

Copy the tables into your science notebook. Use the Periodic Table to fill in the missing information.

Symbol	Element
O	*oxygen*
N	nitrogen
Fe	*iron*
Co	cobalt
Au	gold
Li	*lithium*

Symbol	Element
Ag	*silver*
Cu	copper
Cl	*chlorine*
Ne	neon
Si	*silicon*
B	*boron*

Share your completed table with a partner. You may or may not need to make revisions based on your discussion.

Elements and Their Symbols Summary

Refer back to the reading passage. Write one sentence to summarize the main idea of each paragraph.

Review your classification of examples and nonexamples from the Explore activity. Does your explanation need to be revised to reflect new information? Rewrite your explanation to include the term *element*.

Student summary statements will vary. Accept all reasonable statements.

Explain, Part 2

Materials

For each student
- RM 15 (from Explain, Part 1)

For student groups
- RM 16

Advance Preparation

- Copy *RM 16: Card Sort* on cardstock, laminate, cut apart, and place in a small plastic resealable bag for each group.

Teacher Instruction

- Provide groups with a prepared set of *RM 16*.
- Instruct students to read and complete "Element or Not?"
- Utilizing facilitation questions, discuss student responses. Allow students to revise their original responses if needed.

Explain, Part 2

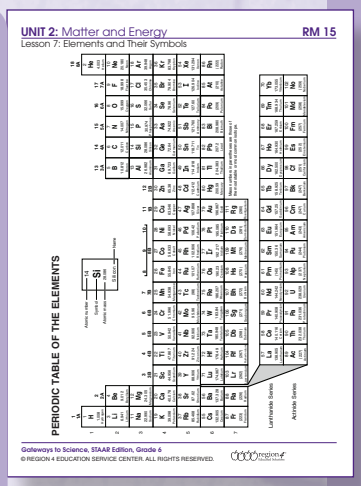
Page 50

Element or Not?

Using the cards your teacher provides, sort into two groups. The cards within each group should have something in common. Once you and your partners have agreed upon the two groups, write a short paragraph explaining how the cards are classified.

Groups are based on elements and nonelements. The nonelements may be mixtures or compounds.

Elements	Nonelements
oxygen	*ice cream*
calcium	*air*
sodium	*salt water*
gold	*steel*
iron	*chocolate milk*
copper	*brass*
silver	*fruit punch*


UNIT 2: Matter and Energy RM 15
Lesson 7: Elements and Their Symbols
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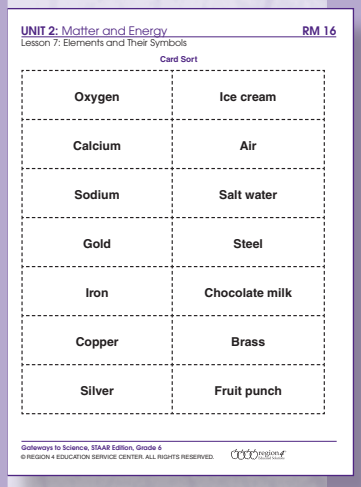
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Card Sort

Oxygen	Ice cream
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Gold	Steel
Iron	Chocolate milk
Copper	Brass
Silver	Fruit punch

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Facilitation Questions

- How did you classify your cards into two categories? *Ask multiple groups and accept all appropriate answers.*
- How many cards contain elements from the Periodic Table? *Seven cards contain elements from the Periodic Table.*
- How can you tell a substance is not an element? *The substance is not pure; the name is not on the Periodic Table.*

Materials
For each student
- ruler or straight edge

Elaborate

Teacher Instruction

- Instruct students to read and discuss "Interpreting Graphs."
- Read the activity aloud and probe students to explain in their own words what they will be doing.
- Model how to make the first table using Figure 2.1. Solicit student volunteers to provide information to complete the table as you model.
- Instruct students to use their science notebooks to complete the other three tables and respond to the questions.
- Discuss student responses, focusing attention on the small number of elements that make up the world in which we live compared to the total number of elements found in the Periodic Table.

Elaborate

Pages 51–53

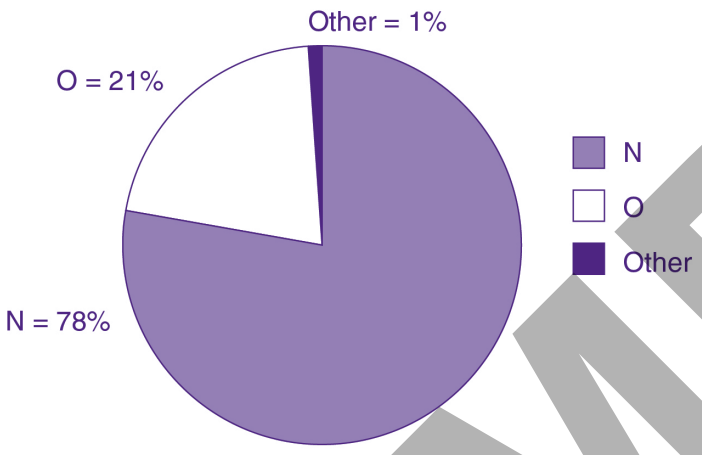
Interpreting Pie Charts

Have you ever wondered what your body is made of? Or what makes up the solid Earth? Or what is in the air we breathe? Like all living matter, our bodies are made up of parts called elements. Elements are the building blocks of the universe. The following pie charts represent the elements that make up most of the world in which we live, including the atmosphere, Earth's crust, sea water, and the human body.

Interpreting Pie Charts

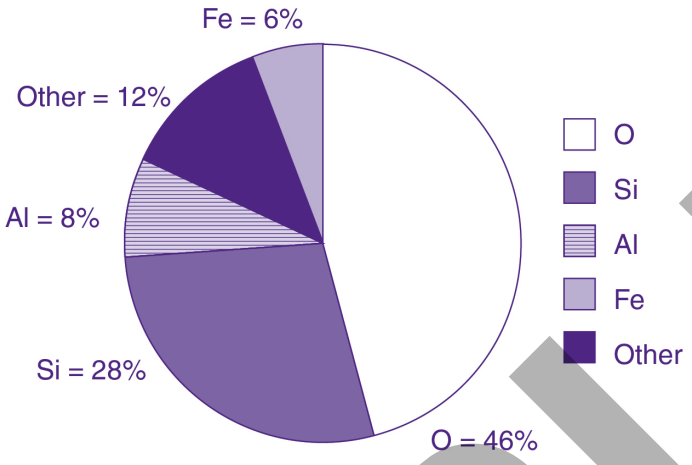
In your science notebook, create a table for each pie chart that includes the title, both the element symbol and the element name, and the percentage. You may use the Periodic Table to identify the elements listed.

Figure 2.1. Composition of Earth's Atmosphere



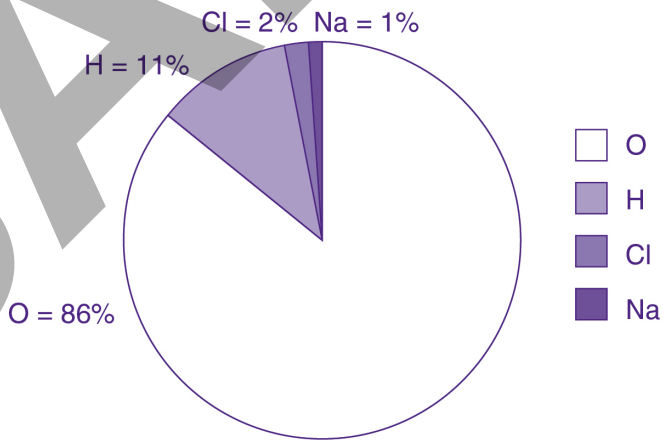
Composition of Earth's Atmosphere		
Name of Element	**Symbol of Element**	**%**
nitrogen	*N*	*78*
oxygen	*O*	*21*
other elements		*1*

Figure 2.2. Composition of Earth's Crust



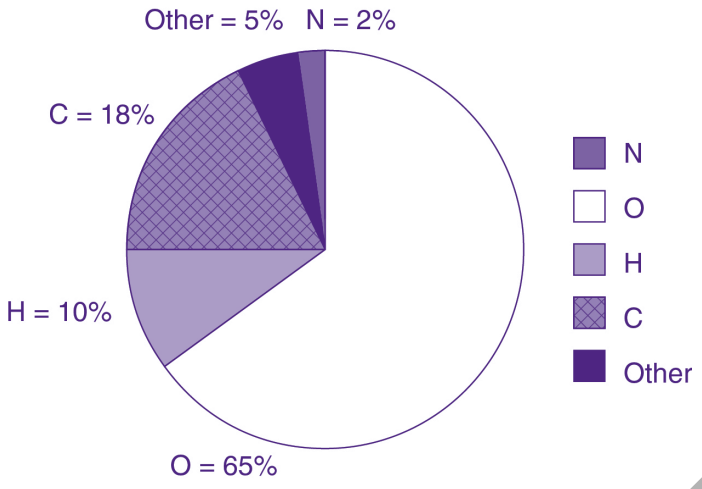
Composition of Earth's Crust		
Name of Element	**Symbol of Element**	**%**
oxygen	*O*	*46*
silicon	*Si*	*28*
aluminum	*Al*	*8*
iron	*Fe*	*6*
other elements		*12*

Figure 2.3. Composition of Sea Water



Composition of Sea Water		
Name of Element	**Symbol of Element**	**%**
oxygen	*O*	*86*
hydrogen	*H*	*11*
chloride	*Cl*	*2*
sodium	*Na*	*1*

Figure 2.4. Composition of the Human Body



Composition of the Human Body		
Name of Element	**Symbol of Element**	**%**
nitrogen	*N*	*2*
oxygen	*O*	*65*
hydrogen	*H*	*10*
carbon	*C*	*18*
other elements		*5*

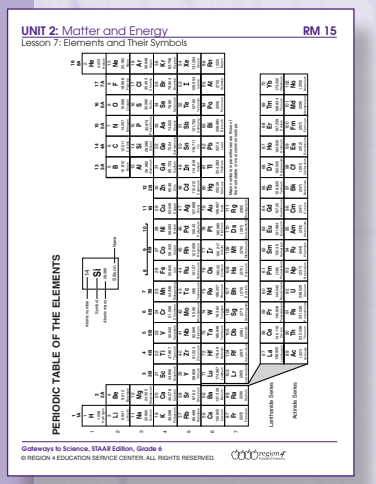
Conclusion

In your science notebook, respond to the questions using complete sentences.

1. Which element or elements are found in all four locations? *oxygen*
2. Which element or elements are found in the human body that are not listed in any of the other locations? *carbon*
3. Which element or elements are found in Earth's crust that are not listed in any of the other locations? *Fe, Si, Al*
4. How many elements are identified on the Periodic Table? *111*
5. Based on all four pie charts, how many different elements make up humans and a majority of the world in which we live? *9*
6. What conclusion can be drawn about the number of elements that make up the majority of the world in which we live and the total number of elements identified on the Periodic Table? *A small number of elements make up most of the world in which we live compared to the large number of elements that have been identified.*

Materials

For each student
- RM 15
- RM 17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Lesson 7: Elements and Their Symbols
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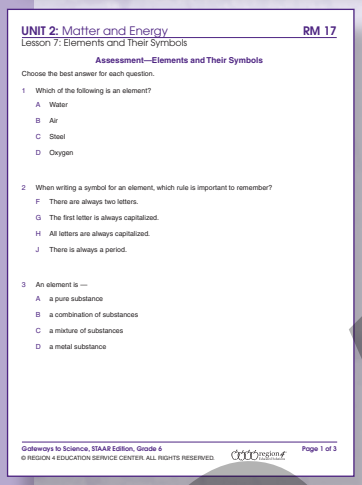
UNIT 2: Matter and Energy RM 17
Lesson 7: Elements and Their Symbols
Assessment—Elements and Their Symbols
Choose the best answer for each question.
1 Which of the following is an element?
A Water
B Air
C Steel
D Oxygen
2 When writing a symbol for an element, which rule is important to remember?
F There are always two letters.
G The first letter is always capitalized.
H All letters are always capitalized.
J There is always a period.
3 An element is —
A a pure substance
B a combination of substances
C a mixture of substances
D a metal substance
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Evaluate

Teacher Instruction

- Provide students with *RM 15: The Periodic Table* to use during the assessment.
- Instruct students to complete *RM 17: Assessment—Elements and Their Symbols*.

RM 17 Answer Key

1. D
2. G
3. A
4. H
5. A

Engage

Gold or Not?

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Your mother doesn't think the sign is correct and doesn't think the ring is pure gold. In science class, you have been studying density, and you remember density is a physical property that can help determine the identity of different substances. The person selling the ring lets you measure the mass and the volume of the ring. You find out the mass is 42 g and the volume is 3 mL. The Internet tells you the density of the element gold is 19.3 g/mL. What can you conclude about the ring on sale? Is the ring pure gold? Explain your answer.

Explore

Example or Nonexample?

- Copy the T-chart into your science notebook.
- Study the example and nonexample shown in the T-chart.

Example	Nonexample
gold	T-shirt

- Classify the objects provided by your teacher as an example or a nonexample.
- Record your classifications on the T-chart you created in your science notebook.
- Discuss with your group an explanation for the classification of the object examples versus nonexamples.
- Record the group's classification on the chart paper provided by your teacher.
- Once your group agrees on the classification table and the explanation, follow your teacher's directions to view other groups' classifications.

Explain, Part 1

- Preview the questions in "Elements and Their Symbols," then read and discuss the passage.
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Why do scientists use chemical symbols?

Writing Chemical Symbols

- The symbol always begins with a capital letter.
- If there is a second or third letter, it is written in lower case.
- Periods are not used at the end of the symbol.

Elements and Their Symbols

Copy the tables into your science notebook. Use the Periodic Table to fill in the missing information.

Symbol	Element
O	
	nitrogen
Fe	
	cobalt
	gold
Li	

Symbol	Element
Ag	
	copper
Cl	
	neon
Si	
B	

Share your completed table with a partner. You may or may not need to make revisions based on your discussion.

Elements and Their Symbols Summary

Refer back to the reading passage. Write one sentence to summarize the main idea of each paragraph.

Review your classification of examples and nonexamples from the Explore activity. Does your explanation need to be revised to reflect new information? Rewrite your explanation to include the term *element*.

Explain, Part 2

Element or Not?

Using the cards your teacher provides, sort into two groups. The cards within each group should have something in common. Once you and your partners have agreed upon the two groups, write a short paragraph explaining how the cards are classified.

Elaborate

Interpreting Pie Charts

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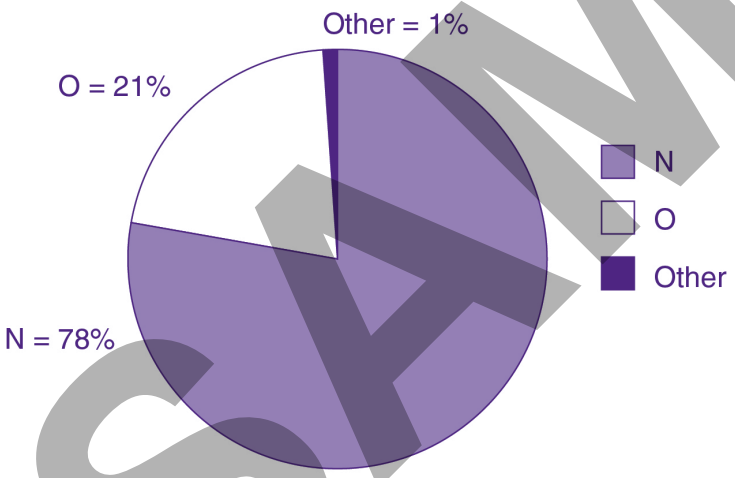


Figure 2.2. Composition of Earth's Crust

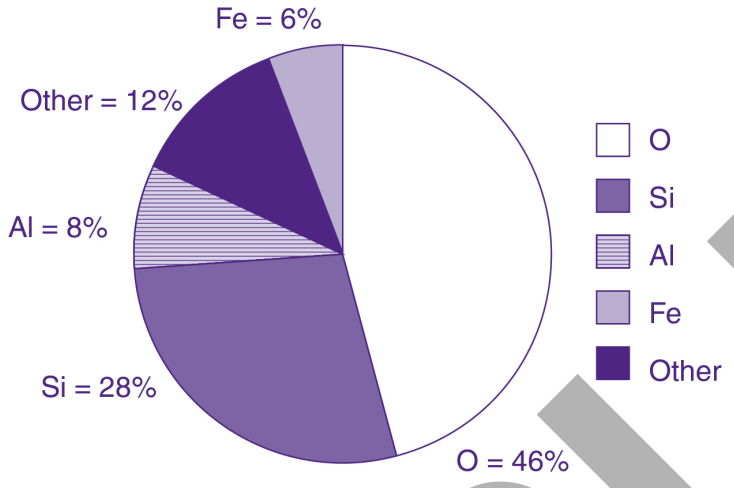


Figure 2.3. Composition of Sea Water

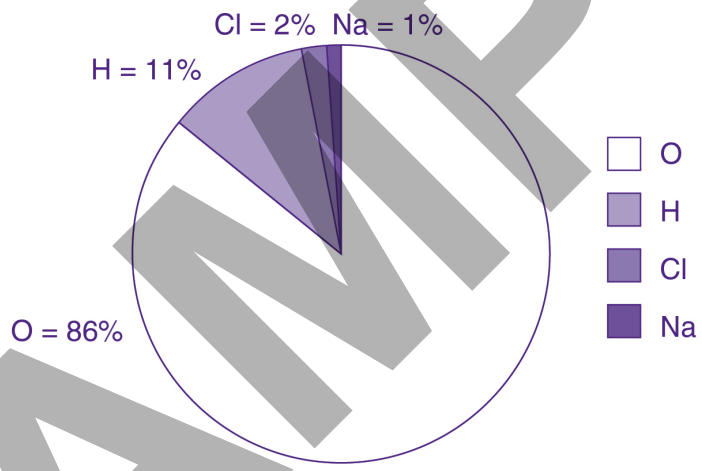
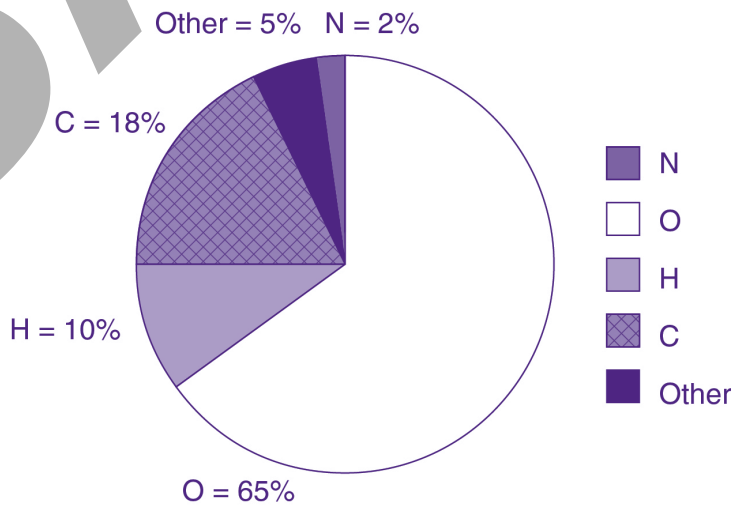


Figure 2.4. Composition of the Human Body



Conclusion

In your science notebook, respond to the questions using complete sentences.

1. Which element or elements are found in all four locations?
2. Which element or elements are found in the human body that are not listed in any of the other locations?
3. Which element or elements are found in Earth's crust that are not listed in any of the other locations?
4. How many elements are identified on the Periodic Table?
5. Based on all four pie charts, how many different elements make up humans and a majority of the world in which we live?
6. What conclusion can be drawn about the number of elements that make up the majority of the world in which we live and the total number of elements identified on the Periodic Table?

Evaluate

Use your knowledge of elements and their symbols to complete the assessment.