

**Elements and the Periodic Table** ▪ *Guided Reading and Study*

## Introduction to Atoms

*This section describes the structure of atoms and how atoms are related to elements.*

### Use Target Reading Skills

Before you read, preview the diagram of a carbon atom in your textbook. Then, complete the graphic organizer by writing two questions about the diagram. As you read, answer your questions.

**Structure of an Atom**

Q. What particles are in the center of an atom?
A.
Q.
A.

### Structure of an Atom

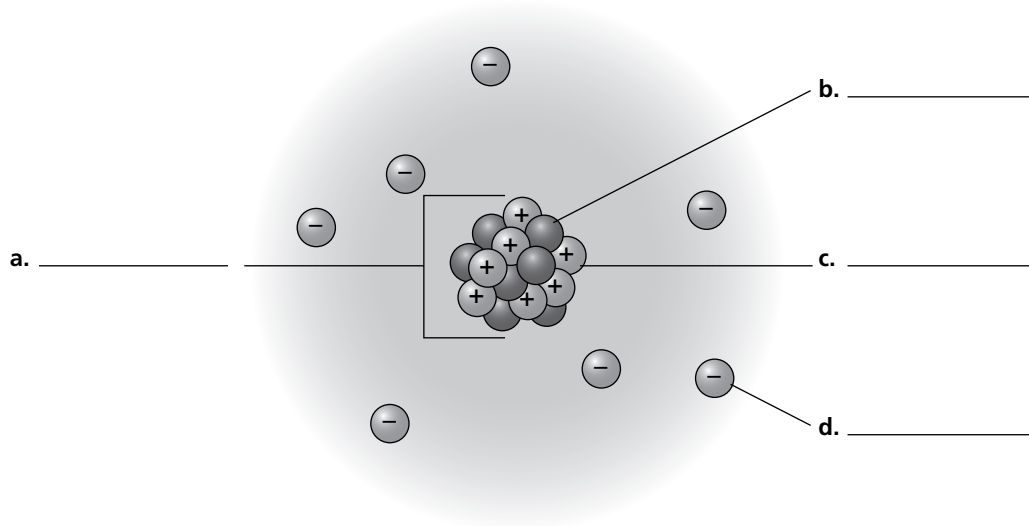
1. Is the following sentence true or false? Atoms are the smallest particles of matter. \_\_\_\_\_

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**Introduction to Atoms** *(Continued)*

2. Label the parts of the atom in the diagram below.



3. Tell why an atom is neutral.

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4. Is the following sentence true or false? Most of an atom's volume is the space in which electrons move \_\_\_\_\_.

5. What parts of an atom make up almost all the mass of an atom?

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**Atoms and Elements**

6. An element can be identified by the number of \_\_\_\_\_ in the nucleus of its atom.

7. What is the atomic number of an element?

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8. What are isotopes?

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9. In the space below, draw two isotopes of carbon and give the mass number for each.

**Modeling Atoms**

10. Circle the letter of each example of a model used in science.

- a. a diagram
- b. a mental picture
- c. a mathematical statement
- d. an object

11. Give two reasons why scientists create models to study atoms.

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**Elements and the Periodic Table** ▪ *Review and Reinforce*

# Introduction to Atoms

## Understanding Ideas

1. Name three particles found in an atom.

\_\_\_\_\_

2. Which two particles are found in an atom's nucleus?

\_\_\_\_\_

3. An atom has the same number of which two particles?

\_\_\_\_\_

4. How many protons are in a carbon atom?

\_\_\_\_\_

5. How are elements identified in terms of their atoms?

\_\_\_\_\_

\_\_\_\_\_

6. Explain why scientists use models to study atoms.

\_\_\_\_\_

\_\_\_\_\_

## Building Vocabulary

*Match each term with its definition by writing the letter of the correct definition on the line beside the term in the left column.*

\_\_\_\_\_ 7. nucleus

\_\_\_\_\_ 8. proton

\_\_\_\_\_ 9. neutron

\_\_\_\_\_ 10. electron

\_\_\_\_\_ 11. atomic number

\_\_\_\_\_ 12. isotope

\_\_\_\_\_ 13. mass number

\_\_\_\_\_ 14. model

a. the sum of protons and neutrons in the nucleus of an atom

b. the very small center core of an atom

c. an atom that differs in the number of neutrons, but has the same number of protons

d. the particle of an atom that moves rapidly around the nucleus

e. an object that helps explain ideas about the natural world

f. the particle of an atom with a positive charge

g. the number of protons in the nucleus of every atom of an element

h. the particle of an atom that is neutral

**Elements and the Periodic Table** ▪ *Guided Reading and Study*

## Organizing the Elements

*This section explains how the elements are organized in a chart called the periodic table. It also explains what information the periodic table contains.*

### Use Target Reading Skills

*Before you read, preview the red headings. In the graphic organizer below, ask a what or how question for each heading. As you read, write the answers to your questions.*

**Patterns in the Elements**

Question	Answer
What pattern of elements did Mendeleev discover?	Patterns appeared when...

### Patterns in the Elements

1. What did Dmitri Mendeleev discover in 1869?

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2. What is the atomic mass of an element?

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3. Mendeleev noticed that patterns appeared when he arranged the elements in what way?

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4. Is the following sentence true or false? Mendeleev also grouped elements that had similar properties. \_\_\_\_\_.

5. Mendeleev's periodic table had \_\_\_\_\_ blank spaces left in it, which represented elements that had not yet been discovered.

6. What does the word *periodic* mean?

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7. A chart of the elements showing the repeating pattern of their properties is called the \_\_\_\_\_.

8. The modern periodic table is now arranged according to \_\_\_\_\_.

**Finding Data on Elements**

9. The atomic number for the element calcium (Ca) is 20. How many protons and electrons does each calcium atom have?

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10. A one- or two-letter representation of an element is called a(n) \_\_\_\_\_.

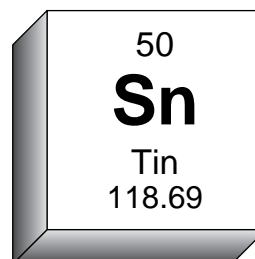
11. Use the square from the periodic table to fill in the blanks below.

a. Name of element: \_\_\_\_\_

b. Chemical symbol: \_\_\_\_\_

c. Atomic mass: \_\_\_\_\_

d. Atomic number: \_\_\_\_\_



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**Organizing the Elements** *(Continued)*

**Organization of the Periodic Table**

12. How can an element's properties be predicted?

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13. Each horizontal row in the periodic table is called a(n)\_\_\_\_\_.

14. Is the following sentence true or false? Across a period from left to right, the properties of elements change according to a pattern.\_\_\_\_\_.

15. Circle the letter of each term that refers to elements in a column of the periodic table.

- a. period
- b. family
- c. group
- d. symbol

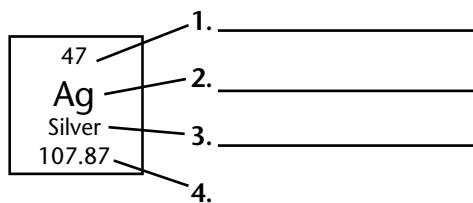
16. Group 15 of the periodic table is the \_\_\_\_\_ family.

17. Circle the letter of the statement that is true about elements in each group.

- a. They all have the same atomic mass.
- b. They all have similar characteristics.
- c. They all have similar atomic numbers.
- d. They all have the same chemical symbol.

**Elements and the Periodic Table** ▪ *Review and Reinforce***Organizing the Elements****Understanding Main Ideas**

The diagram below is a square from the periodic table. Label the four facts shown about each element.



Answer the following on a separate sheet of paper.

- In what order did Mendeleev arrange the elements in the periodic table?
- What do elements in the same column in the periodic table have in common?
- What can you predict about an element from its position in the periodic table?

**Building Vocabulary**

From the list below, choose the term that best completes each sentence.

atomic mass      period  
chemical symbol      group  
periodic table

- An element's \_\_\_\_\_ is its row in the periodic table.
- Mendeleev was the first to arrange elements according to their properties in a(n) \_\_\_\_\_.
- Elements in a(n) \_\_\_\_\_, or family, of the periodic table have similar characteristics.
- A(n) \_\_\_\_\_ is an abbreviation for the name of an element and has either one or two letters.
- The \_\_\_\_\_ of an element is the average mass of all the isotopes of that element.

**Elements and the Periodic Table** ▪ *Guided Reading and Study*

## Metals

*This section describes the properties of metals and the characteristics of the different groups of metals.*

### Use Target Reading Skills

*Before you read, write what you know about the metals in the top box. As you read, write what you learn in the bottom box.*

What You Know
1. Metals are shiny.
2.
3.
4.
5.

What You Learned
1.
2.
3.
4.
5.

### Properties of Metals

1. Chemists classify an element as a metal, based on its physical and chemical \_\_\_\_\_.

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**Elements and the Periodic Table** ▪ *Guided Reading and Study*

**Metals** *(continued)*

2. Circle the letter of the property that is NOT a physical property of metals.
- a. shininess
  - b. malleability
  - c. brittleness
  - d. conductivity

Match the term with its definition.

Term	Definition
_____ 3. malleable	a. The ease with which an element combines with other elements and compounds.
_____ 4. ductile	b. The ability of an object to transfer heat or electricity to another object.
_____ 5. conductivity	c. A term used to describe a material that can be pulled out, or drawn, into a long wire.
_____ 6. reactivity	d. A term used to describe a material that can be hammered or rolled into flat sheets and other shapes.

7. Some metals are \_\_\_\_\_; they are attracted to magnets or can be made into magnets.
8. Is the following sentence true or false? Most metals are solids at room temperature. \_\_\_\_\_
9. The slow destruction of a metal through its reaction with oxygen in the air is called \_\_\_\_\_.

**Metals in the Periodic Table**

10. How does the reactivity of each group of metals change as you move across the table from left to right?

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11. Circle the letter of each sentence that is true about alkali metals.
- a. They are never found as uncombined elements.
  - b. They react with other elements by losing one electron.
  - c. They are often found as pure elements in sea water.
  - d. They are slightly reactive.

**Elements and the Periodic Table** ▪ *Guided Reading and Study*

12. What are the two most important alkali metals?

\_\_\_\_\_

13. Circle the letter of each sentence that is true about alkaline earth metals.

- a. Each is a good conductor of electricity.
- b. They are never found uncombined in nature.
- c. They lose two electrons in chemical reactions.
- d. They are much less reactive than most metals.

14. What are the two most common alkaline earth metals?

\_\_\_\_\_

15. Circle the letter of each element that is a transition metal.

- a. gold
- b. iron
- c. copper
- d. lithium

16. Is the following sentence true or false? The transition metals are less reactive than the metals in Groups 1 and 2. \_\_\_\_\_

17. Is the following sentence true or false? All of the elements in Groups 13 through 15 are metals. \_\_\_\_\_

18. Where are the lanthanides placed on the periodic table?

\_\_\_\_\_  
\_\_\_\_\_

19. Lanthanides are often mixed with more common metals to make \_\_\_\_\_.

20. Where are the actinides found on the periodic table?

\_\_\_\_\_  
\_\_\_\_\_

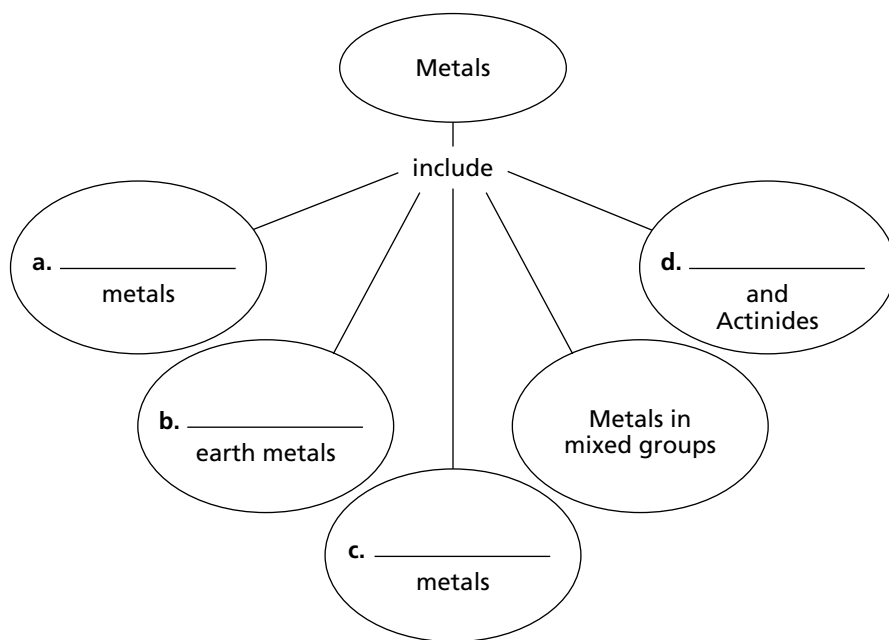
21. Which two actinides occur naturally on Earth?

\_\_\_\_\_

**Elements and the Periodic Table** ▪ *Guided Reading and Study*

**Metals** (Continued)

22. Complete the concept map about metals.



**Synthetic Elements**

23. Uranium has an atomic number of 92. How were all the elements with atomic numbers higher than 92 created?

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24. What was the first synthetic element to be made by colliding nuclei in a particle accelerator?

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25. Is the following sentence true or false? It is easier to synthesize new elements with very large atomic numbers. \_\_\_\_\_

**Elements and the Periodic Table** ▪ *Review and Reinforce*

# Metals

**Understanding Main Ideas**

Answer the following on a separate sheet of paper. Use the periodic table in Appendix D.

1. What category of element is the most common in the periodic table? Where is that category found in the periodic table?
2. Sodium (Na) and calcium (Ca) are in different families of metals. Name the families of metals in which they belong, and describe each family's characteristics.
3. Would a metal in Group 13 be more or less reactive than a metal in Group 1? Explain.
4. In what periods are the lanthanides and actinides? Where are they placed in the periodic table? Why?

**Building Vocabulary**

Write the correct term on each line to complete the sentence.

conductivity

alloy

malleable

ductile

corrosion

particle accelerator

reactivity

5. The reaction of a metal with oxygen to form rust is called \_\_\_\_\_.
6. A material that is \_\_\_\_\_ can be hammered into sheets and other shapes.
7. A powerful machine called a(n) \_\_\_\_\_ moves nuclear particles fast enough to make larger nuclei when the particles collide.
8. The ability to transmit heat or electricity to other objects is called \_\_\_\_\_.
9. A material that is \_\_\_\_\_ can be drawn into a wire.
10. \_\_\_\_\_ is the ease and speed with which an element combines with other elements and compounds.
11. A(n) \_\_\_\_\_ is a mixture of a metal and at least one other element.

**Elements and the Periodic Table** ▪ *Guided Reading and Study*

## Nonmetals and Metalloids

*This section describes the properties of the elements in the periodic table that are not metals.*

### Use Target Reading Skills

*Before you read, write what you know about nonmetals and metalloids in the top box. As you read, write what you learn in the bottom box.*

What You Know
1. Nonmetals are not shiny.
2.
3.
4.
5.

What You Learned
1.
2.
3.
4.
5.

### Properties of Nonmetals

1. The elements that lack most of the properties of metals are called \_\_\_\_\_.
2. Where are the nonmetals located on the periodic table?  
\_\_\_\_\_  
\_\_\_\_\_

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**Nonmetals and Metalloids** *(continued)*

3. Is the following sentence true or false? Several of the nonmetals are gases at room temperature. \_\_\_\_\_
4. Circle the letter of each sentence that is true about the physical properties of nonmetals.
  - a. Solid nonmetals are brittle.
  - b. They usually have lower densities than metals.
  - c. Most are shiny.
  - d. They are good conductors of both heat and electricity.
5. Except for the Group 18 elements, most nonmetals readily form \_\_\_\_\_.

**Families of Nonmetals**

6. Circle the letter of the number of electrons that an atom in the carbon family can gain, lose, or share.
  - a. 1
  - b. 4
  - c. 5
  - d. 6
7. All living things contain what kind of compounds?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
8. Circle the letter of the number of electrons that an atom in the nitrogen family usually gains or shares.
  - a. 2
  - b. 7
  - c. 5
  - d. 3
9. The atmosphere is almost 80 percent \_\_\_\_\_.
10. A molecule composed of two identical atoms is called a(n) \_\_\_\_\_.
11. Circle the letter of the number of electrons that an atom in the oxygen family usually gains or shares.
  - a. 6
  - b. 7
  - c. 5
  - d. 2
12. Circle the letter of each sentence that is true about oxygen.
  - a. The oxygen you breathe is a diatomic molecule.
  - b. Oxygen rarely combines with other elements.
  - c. Oxygen is the most abundant element in Earth's crust.
  - d. Ozone (O<sub>3</sub>) collects in a layer in the upper atmosphere.

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13. Circle the letter of the number of electrons that an atom in the halogen family usually gains or shares.

- a. 4
- b. 1
- c. 6
- d. 3

14. Is the following sentence true or false? Uncombined halogens are dangerous to humans. \_\_\_\_\_.

15. Circle the letter of each sentence that is true about the noble gases.

- a. They exist in large amounts in the atmosphere.
- b. They are chemically unreactive.
- c. They readily gain, lose, or share electrons.
- d. They are used in glowing electric lights.

16. Complete the table about families of nonmetals.

**Nonmetals**

Family	Group Number	Nonmetals in Family
a. Carbon family		
b. Nitrogen family		
c. Oxygen family		
d. Halogen family		
e. Noble gases		

17. How many protons and electrons does a hydrogen atom have?

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18. Why can't hydrogen be grouped in a family?

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**Elements and the Periodic Table** ▪ *Guided Reading and Study*

**Nonmetals and Metalloids** *(continued)*

**The Metalloids**

19. What are metalloids?

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20. What is the most common metalloid? \_\_\_\_\_

21. What is the most useful property of the metalloids?

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22. What are semiconductors?

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**Elements and the Periodic Table** ▪ *Review and Reinforce***Nonmetals and Metalloids****Understanding Main Ideas**

Complete the following table. Use the periodic table in Appendix D.

Element	Metal, Metalloid, or Nonmetal	Family Name
Arsenic	1.	
Sulfur	2.	
Tin	3.	
Neon	4.	
Chlorine	5.	
Silicon	6.	

Answer the following questions on a separate sheet of paper.

- Where in the periodic table are the nonmetals located? Where are the metalloids?
- What element is not grouped with others in a family? What is its usual atomic structure?

**Building Vocabulary**

Match each term with its definition by writing the letter of the correct definition in the right column on the line beside the term in the left column.

- |                            |  |
|----------------------------|--|
| _____ 9. diatomic molecule | a. a type of element that has some of the characteristics of metals and some of nonmetals              |
| _____ 10. halogen          | b. a family of unreactive elements whose atoms do not gain, lose, or share valence electrons           |
| _____ 11. metalloid        | c. formed of two identical atoms   |
| _____ 12. noble gases      | d. a substance that carries electricity under certain circumstances, but not under other circumstances |
| _____ 13. nonmetal         | e. a type of element whose physical properties are generally opposite to that of metals                |
| _____ 14. semiconductor    | f. a family of very reactive elements whose atoms gain or share one electron                           |