

**HOLT CALIFORNIA** 

# **Physical Science**

## **Study Guide A**

### **with Directed Reading Worksheets**



**HOLT, RINEHART AND WINSTON**

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## TO THE STUDENT

Do you need to review the concepts in the text? If so, this booklet will help you. The *Study Guide* is an important tool to help you organize what you have learned from the chapter so that you can succeed in your studies. The booklet contains a Directed Reading worksheet and a Vocabulary and Section Summary worksheet for each section of the chapter.

Use these worksheets in the following ways:

- as a reading guide to identify and study the main concepts of each chapter before or after you read the text
- as a place to record and review the main concepts and definitions from the text
- as a reference to determine which topics you have learned well and which topics you may need to study further

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# Directed Reading A

## Section: Science and Scientists (pp. 8–13)

### STARTING WITH A QUESTION

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What is knowledge obtained by investigating the natural world called?
- a. questions
  - b. science
  - c. facts
  - d. nature

### In Your Own Neighborhood

- \_\_\_\_\_ 2. What might happen if you looked at your neighborhood in a new way?
- a. You might ask questions.
  - b. You might discover a new planet.
  - c. You might get sick.
  - d. You might not get home.

### The World and Beyond

- \_\_\_\_\_ 3. What places do scientists ask questions about?
- a. only about Earth
  - b. only about what's around them
  - c. only about things they see
  - d. about any place in the universe

## INVESTIGATION: THE SEARCH FOR ANSWERS

### Research

Use the terms from the following list to complete the sentences below.

experimentation      research      observation

4. Looking up information on the Internet is \_\_\_\_\_.
5. Carefully looking and recording what you see is \_\_\_\_\_.
6. Using different mirrors to see how your reflection changes is \_\_\_\_\_.

**Directed Reading A *continued***

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**APPLYING THE ANSWERS**

**Saving Lives**

- \_\_\_\_\_ 7. How have scientists helped protect people during automobile accidents?
- a. Scientists have made cars faster.
  - b. Scientists have made larger engines.
  - c. Scientists have designed air bags.
  - d. Scientists have made fuel less expensive.

**Saving Resources**

- \_\_\_\_\_ 8. What has science done to help make resources last longer?
- a. found ways to recycle steel
  - b. found ways to use more water
  - c. found ways to avoid recycling
  - d. found ways to fix used cars

**Protecting the Environment**

- \_\_\_\_\_ 9. How do chlorofluorocarbons harm the environment?
- a. They keep sunlight from Earth.
  - b. They pollute water.
  - c. They harm the ozone layer.
  - d. They cause storms.
- \_\_\_\_\_ 10. What does the ozone layer do?
- a. It keeps storms from harming Earth.
  - b. It protects the planet from harmful UV light.
  - c. It allows more sunlight to reach the planet.
  - d. It pollutes the air.

**SCIENTISTS EVERYWHERE**

**Meteorologist**

**Match the correct description with the correct term. Write the letter in the space provided.**

- |  |                        |
|--|------------------------|
| _____ 11. a scientist who studies volcanoes                        | a. meteorologist       |
| _____ 12. a person who studies the atmosphere                      | b. ecologist           |
| _____ 13. a person who draws scientific pictures                   | c. geochemist          |
| _____ 14. a person who studies the make-up of rocks                | d. volcanologist       |
| _____ 15. a person who studies living things and their environment | e. science illustrator |

## Directed Reading A

### Section: Scientific Methods (pp. 14–21)

#### WHAT ARE SCIENTIFIC METHODS?

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What are the ways that scientists answer questions and solve problems?
- a. physical science
  - b. physics
  - c. observations
  - d. scientific methods

#### ASKING A QUESTION

- \_\_\_\_\_ 2. In the figure showing scientific methods, which of the following is NOT a step?
- a. testing the hypothesis
  - b. answering a question
  - c. drawing conclusions
  - d. making observations
- \_\_\_\_\_ 3. How do scientists use scientific methods?
- a. They always use all the steps.
  - b. They always use the steps in the same order.
  - c. They use the steps in different ways.
  - d. They never do steps over again.
- \_\_\_\_\_ 4. What does asking questions help scientists to do?
- a. find answers with less investigation
  - b. focus the purpose of an investigation
  - c. memorize answers
  - d. know where to find answers
- \_\_\_\_\_ 5. What is the word for using the senses to gather information?
- a. investigation
  - b. measurement
  - c. knowledge
  - d. observation

## Directed Reading A *continued*

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### A Real-World Question

- \_\_\_\_\_ 6. What is the comparison of energy output with energy input?
- a. efficiency
  - b. hypothesis
  - c. observation
  - d. physical science
- \_\_\_\_\_ 7. When scientists studied boat propulsion, what did they learn about propellers?
- a. They are efficient but unreliable.
  - b. They are efficient.
  - c. They are not very efficient.
  - d. They are not efficient but reliable.

### The Importance of Boat Efficiency

- \_\_\_\_\_ 8. Why is it important to make boats and ships more efficient?
- a. to use less fuel
  - b. to use more fuel
  - c. to spend more money
  - d. to make boats slower
- \_\_\_\_\_ 9. Based on their observations, what question did the MIT scientists ask?
- a. How can boat propulsion be made less efficient?
  - b. How can boat propulsion be made more efficient?
  - c. How can boat propellers be made less efficient?
  - d. How can penguins be made more efficient?

### FORMING A HYPOTHESIS

- \_\_\_\_\_ 10. What is a possible explanation based on knowledge and observation called?
- a. a scientific law
  - b. physical science
  - c. a theory
  - d. a hypothesis
- \_\_\_\_\_ 11. What should be true of a good hypothesis?
- a. It should be reusable.
  - b. It should be testable.
  - c. It should be a question.
  - d. It should be untrue.



## Directed Reading A *continued*

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### A Possible Answer from Nature

- \_\_\_\_\_ 12. What observations led Czarnowski to form his hypothesis?
- a. how easily penguins propel themselves
  - b. how easily boats propel themselves
  - c. how badly penguins propel themselves
  - d. how badly boats propel themselves
- \_\_\_\_\_ 13. What was Czarnowski's hypothesis about propulsion systems?
- a. Propeller-driven systems are always efficient.
  - b. Penguin-like systems are less efficient.
  - c. Penguin-like systems are more efficient.
  - d. Propeller-driven systems are more efficient.

### Making Predictions

- \_\_\_\_\_ 14. What do scientists do before testing a hypothesis?
- a. make another hypothesis
  - b. answer all questions
  - c. make predictions
  - d. make errors

### TESTING THE HYPOTHESIS

- \_\_\_\_\_ 15. What must you do after you form a hypothesis?
- a. Test the hypothesis.
  - b. Change the hypothesis.
  - c. Disprove a prediction.
  - d. Answer the hypothesis.
- \_\_\_\_\_ 16. What should you do if you test your hypothesis and find that it is off the mark?
- a. Stop working on the problem.
  - b. Change the hypothesis.
  - c. Don't change the hypothesis.
  - d. Don't test the hypothesis again.

### Controlled Experiments

- \_\_\_\_\_ 17. What did the MIT scientists use to test their hypothesis?
- a. a model penguin
  - b. a boat with a penguin-like shape
  - c. a boat with penguin-like flippers
  - d. a computer model

**Directed Reading A *continued***

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**Use the terms from the following list to complete the sentences below.**

controlled experiment    experimental group  
variable parameter                      controlled parameter

- 18.** A group that is the same as the control group except for one factor is a(n) \_\_\_\_\_.
- 19.** A factor that makes the experimental group different from the control group is a(n) \_\_\_\_\_.
- 20.** An experiment that compares results from a control group and experimental groups is a(n) \_\_\_\_\_.
- 21.** A factor that is kept the same between groups is a(n) \_\_\_\_\_.

**Testing *Proteus***

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ **22.** What are any pieces of information gathered through experimentation called?
- a.** factors
  - b.** particles
  - c.** ideas
  - d.** data

**ANALYZING THE RESULTS**

- \_\_\_\_\_ **23.** What must you find out after conducting an experiment and collecting data?
- a.** if the answers are right
  - b.** if the results support your hypothesis
  - c.** if the answers can be corrected
  - d.** if the results can be changed
- \_\_\_\_\_ **24.** Why do scientists do calculations and create tables and graphs?
- a.** to help them develop hypotheses
  - b.** to make analyzing results easier
  - c.** to impress other scientists
  - d.** to conduct a controlled experiment

## Directed Reading A *continued*

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### Analyzing *Proteus*

- \_\_\_\_\_ 25. What were used to show the data collected in the *Proteus* experiment?
- a. books and reports
  - b. propellers and flippers
  - c. line and bar graphs
  - d. television and radio

### DRAWING CONCLUSIONS

- \_\_\_\_\_ 26. What must you do at the end of an investigation?
- a. Draw a conclusion.
  - b. Draw a bar graph.
  - c. Draw a picture.
  - d. Make a line graph.

### The *Proteus* Conclusion

- \_\_\_\_\_ 27. What conclusion did the scientists come to after they analyzed results of the *Proteus* test?
- a. Their hypothesis was not supported.
  - b. They needed a new investigation.
  - c. Their hypothesis was supported.
  - d. They had too much data.

### COMMUNICATING RESULTS

- \_\_\_\_\_ 28. Why is it important to communicate the results of scientific investigations?
- a. so other scientists can verify your results
  - b. to get the credit
  - c. because the question is answered
  - d. to prevent other scientists from doing their own tests
- \_\_\_\_\_ 29. Where did the MIT scientists publish their results about *Proteus*?
- a. nowhere
  - b. television, radio, and the Internet
  - c. academic papers, science magazines, and the Internet
  - d. books, magazines, and comic books

Skills Worksheet

# Directed Reading A

## Section: Safety in Science (pp. 22–27)

### KEEPING YOURSELF SAFE

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which of the following is NOT a way to keep yourself safe in a lab?
- a. wearing proper safety equipment
  - b. being careful to prevent accidents
  - c. bumping into people in the lab
  - d. using lab materials in a safe way

### Avoiding Accidents

- \_\_\_\_\_ 2. How can you help avoid accidents in the lab?
- a. Pay attention, and follow directions.
  - b. Don't ask questions or do experiments.
  - c. Walk around, and talk to your friends.
  - d. Ignore what is happening around you.

### Reporting Accidents

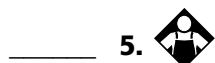
- \_\_\_\_\_ 3. If there is an accident, what should you do?
- a. Run out of the classroom.
  - b. Let your teacher know right away.
  - c. Don't tell anyone.
  - d. Scream and jump up and down.

## ELEMENTS OF SAFETY

### Understanding Safety Symbols

- \_\_\_\_\_ 4. What do safety symbols tell you?
- a. how to bake cookies
  - b. what precautions to take
  - c. how to do experiments
  - d. when to leave the classroom

Match each safety symbol with the correct meaning. Write the letter in the space provided.



- a. sharp object
- b. heating safety
- c. clothing protection

## Directed Reading A *continued*

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### Following Safety Symbols

- \_\_\_\_\_ 8. What will your teacher explain to you about each safety symbol?
- what precautions it requires
  - how to draw it
  - where to find it
  - when to follow it
- \_\_\_\_\_ 9. What should you do if you see the symbol for heating safety?
- Wash your hands.
  - Stop working on the activity.
  - Clear flammable things off your work area.
  - Take off your safety equipment.

### Following Directions

- \_\_\_\_\_ 10. What should you always do before a science activity?
- Take off your safety equipment.
  - Talk to your best friend about it.
  - Read all instructions very carefully.
  - Leave the room.
- \_\_\_\_\_ 11. If you don't understand directions, who should you ask to explain them?
- the school principal
  - your parents
  - your best friend
  - your science teacher

### Neatness

- \_\_\_\_\_ 12. Why should you be neat when you work in a science lab?
- to make your work area look nice
  - to please your teacher
  - so you will be safer
  - so you can go home early

### Using Proper Safety Equipment

- \_\_\_\_\_ 13. What should you always wear when you enter the lab area?
- heat-resistant gloves
  - safety goggles
  - rubber boots
  - ear phones

### Directed Reading A *continued*

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- \_\_\_\_\_ 14. What should you do if you need to handle hot objects?
- a. Use your apron.
  - b. Ask your friend to handle them.
  - c. Call the teacher.
  - d. Wear heat-resistant gloves.

#### **Cleaning Up**

- \_\_\_\_\_ 15. What should you do with a cracked glass bowl after an activity?
- a. Give it to your teacher.
  - b. Ask your friend what to do with it.
  - c. Take it home.
  - d. Try to repair it.

**Match each description with the correct safety element. Write the letter in the space provided.**

- |  |                                     |
|--|-------------------------------------|
| _____ 16. clearing books off your work area                | a. recognizing safety symbols       |
| _____ 17. wiping your work area with damp paper towels     | b. following directions             |
| _____ 18. wearing goggles and an apron                     | c. practicing neatness              |
| _____ 19. knowing what the symbol of a small animal means  | d. using the right safety equipment |
| _____ 20. doing what the instructions and your teacher say | e. cleaning up properly             |

#### **RESPONDING TO ACCIDENTS**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 21. Why should you know where emergency equipment is located in your lab?
- a. so you can do experiments
  - b. so you can get it after an accident
  - c. so you can prevent accidents
  - d. so you can go home early

**Directed Reading A *continued***

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**Proper Accident Procedures**

- \_\_\_\_\_ **22.** What should you do first after an accident?
- a.** Tell the principal.
  - b.** Leave the area with your friends.
  - c.** Scream for help.
  - d.** Make sure you are safe.

**Use the terms from the following list to complete the sentences below..**

first aid

accident

- 23.** Always report a(n) \_\_\_\_\_ to your teacher even if you are afraid you will get in trouble.
- 24.** Emergency medical care for someone who has been hurt or who is sick is called \_\_\_\_\_.

**Procedures for Accidental Injuries**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ **25.** What can you do if someone gets a heat burn?
- a.** Apply pressure with a paper towel.
  - b.** Hold the burn under cold water.
  - c.** Bring food to the injured person.
  - d.** Wash out the eyes in an eye bath.
- \_\_\_\_\_ **26.** How should you treat a cut?
- a.** Wash the cut in an eye bath.
  - b.** Rinse the cut and hold it under cold water.
  - c.** Rinse the cut and apply pressure.
  - d.** Bring food to the injured person.

# Vocabulary and Section Summary A

## Science and Scientists

### VOCABULARY

In your own words, write a definition of the following term in the space provided.

1. science

---

---

### SECTION SUMMARY

Read the following section summary.

- Scientific progress is made by asking meaningful questions and conducting careful investigations.
- Three methods of investigation are research, observation, and experimentation.
- Science affects people's daily lives. Science can help save lives and resources and can help improve the environment.
- There are several types of scientists and many jobs that use science.



# Vocabulary and Section Summary A

## Scientific Methods

### VOCABULARY

In your own words, write a definition of the following term in the space provided.

1. scientific methods

---

---

2. observation

---

---

3. hypothesis

---

---

4. data

---

---

### SECTION SUMMARY

Read the following section summary.

- Scientific methods are the ways in which scientists answer questions and solve problems.
- Asking a question usually results from making an observation. Questioning is often the first step in using scientific methods.
- A hypothesis is a possible explanation or answer to a question. A good hypothesis is testable by an experiment.
- After performing an experiment, you should analyze your results. Analyzing is usually done by using calculations, tables, and graphs.
- After analyzing your results, you should draw conclusions about whether your hypothesis is supported.
- Communicating your results allows others to check or continue your work. You can communicate through reports, posters, and the Internet.

# Vocabulary and Section Summary A

## Safety in Science

### VOCABULARY

In your own words, write a definition of the following term in the space provided.

1. first aid

---

---

### SECTION SUMMARY

Read the following section summary.

- Appropriate safety precautions must always be taken when conducting scientific investigations.
- Scientists use symbols to alert them to particular dangers that they face when performing experiments in science.
- Goggles, gloves, and aprons are proper safety equipment that should be used in a science laboratory.
- If you suffer any injury during an experiment, inform your teacher immediately.
- Proper first-aid procedures must be followed when an accident occurs in the lab.

# Directed Reading A

## Section: Tools and Models in Science (pp. 42–49)

Write the letter of the correct answer in the space below.

- \_\_\_\_\_ 1. How can a tool best be described?
- a. anything that helps you do a task
  - b. anything that gives you energy
  - c. anything that uses electricity
  - d. anything that has a handle

### TOOLS IN SCIENCE

- \_\_\_\_\_ 2. Which of the following should you do when you collect data?
- a. Use faulty measurement tools.
  - b. Clean your tools.
  - c. Use the proper measurement tools.
  - d. Use inaccurate measurements.
- \_\_\_\_\_ 3. Which of the following tools is NOT used to evaluate and analyze data?
- a. calculator
  - b. meterstick
  - c. graph
  - d. computer

### MAKING MEASUREMENTS

- \_\_\_\_\_ 4. How was an inch measured in England many years ago?
- a. by using grains of barley
  - b. by using calculators
  - c. by using flower petals
  - d. by using corn stalks

### The International System of Units

- \_\_\_\_\_ 5. What is the system of measurement used by most scientists called?
- a. the International System of Measures
  - b. the French System of Units
  - c. the Universal Unit System
  - d. the International System of Units

**Directed Reading A *continued***

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- \_\_\_\_\_ 6. Which of the following is another name for the SI system of measurement?
- a. the French academy system
  - b. the metric system
  - c. the International Unit System
  - d. the National System of Measurement
- \_\_\_\_\_ 7. What are all units of the SI system of measurement based on?
- a. the number 5
  - b. the number 10
  - c. the number 1,000
  - d. the number 15
- \_\_\_\_\_ 8. In measuring, what does *kilo-* mean?
- a. 10 times
  - b. 100 times
  - c. 1,000 times
  - d. 10,000 times
- \_\_\_\_\_ 9. In measuring, what does *milli-* mean?
- a. 1/100 times
  - b. 5/100 times
  - c. 1/2,000 times
  - d. 1/1,000 times

**Length**

- \_\_\_\_\_ 10. What is the basic SI unit of length?
- a. a meter
  - b. a kilogram
  - c. a kelvin
  - d. a milli

**Mass**

**Use the terms from the following list to complete the sentences below.**

mass                      liter  
volume                    density                      kilogram

11. The amount of matter in an object is its \_\_\_\_\_.
12. The basic SI unit for mass is the \_\_\_\_\_.
13. A measure of the size of an object is its \_\_\_\_\_.
14. A unit of measure used to express liquid volume is  
the \_\_\_\_\_.
15. The ratio of the mass of a substance to the volume of the substance  
is its \_\_\_\_\_.

**Directed Reading A *continued***

---

**Temperature**

**Write the letter of the correct answer in the space below.**

- \_\_\_\_\_ 16. Which of the following is a measure of how hot or how cold something is?
- a. temperature
  - b. mass
  - c. length
  - d. volume
- \_\_\_\_\_ 17. Which of the following are NOT units used to measure temperature?
- a. grams
  - b. degrees Fahrenheit
  - c. kelvins
  - d. degrees Celsius

**MODELS IN SCIENCE**

- \_\_\_\_\_ 18. What is a representation of an object or process called?
- a. an estimate
  - b. a sample
  - c. a model
  - d. data
- \_\_\_\_\_ 19. Which of the following uses something familiar to explain something unfamiliar?
- a. a thermometer
  - b. a tool
  - c. a calculator
  - d. a model

**Physical Models**

**Use the terms from the following list to complete the sentences below.**

conceptual model                      physical model  
mathematical model                  variable

20. A doll is an example of a(n) \_\_\_\_\_.
21. A model can make an inaccurate prediction if a wrong \_\_\_\_\_ is used.
22. A model that puts many ideas together to explain or summarize something is called a(n) \_\_\_\_\_.
23. A model that is used to predict the weather is an example of a(n) \_\_\_\_\_.

## Directed Reading A *continued*

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### Models: The Right Size

Write the letter of the correct answer in the space below.

- \_\_\_\_\_ 24. Which of the following is used to represent things that are very small or very large?
- a. a model
  - b. a cylinder
  - c. a tool
  - d. data

### The Limits of Models

- \_\_\_\_\_ 25. Why are models limited in their usefulness?
- a. Models are too difficult to make.
  - b. Models are never used in science.
  - c. Models are not exactly like the real object.
  - d. Models are never accurate.

### USING MODELS FOR SCIENTIFIC PROGRESS

- \_\_\_\_\_ 26. Which of the following statements about models is NOT true?
- a. Scientists use models to communicate information.
  - b. Models cannot help explain difficult information.
  - c. Models can represent scientific ideas and objects.
  - d. Models help explain difficult information.

### SCIENTIFIC THEORIES

Match the correct definition with the correct term. Write the letter in the space provided.

- |  |           |
|--|-----------|
| _____ 27. a system of ideas that explains observations and is supported by scientific evidence | a. law    |
| _____ 28. a statement or equation that reliably predicts events under certain conditions       | b. theory |
| _____ 29. a representation used by scientists to explain theories and construct laws           | c. model  |

# Directed Reading A

## Section: Organizing Your Data (pp. 50–55)

### CREATING A DATA TABLE

Write the letter of the correct answer in the space below.

- \_\_\_\_\_ 1. Which of the following can be the first step in organizing data?
- Choose a topic.
  - Gather information.
  - Create a data table.
  - Analyze the data.

### Organizing: The First Step

- \_\_\_\_\_ 2. Which of the following must you determine before starting an experiment?
- what information you will gather
  - what conclusions you will draw
  - how you will interpret the data
  - whether your hypothesis is correct

### Independent and Dependent Variables

- \_\_\_\_\_ 3. The factor in an experiment that the investigator can change is called what?
- the dependent variable
  - an observation
  - the independent variable
  - an estimate
- \_\_\_\_\_ 4. Where is the independent variable found in a data table?
- in the first column
  - in the estimate column
  - in the second column
  - in the experiment column
- \_\_\_\_\_ 5. The factor that the scientist measures in an experiment is called what?
- the independent variable
  - the density
  - an estimate
  - the dependent variable
- \_\_\_\_\_ 6. Where is the dependent variable found in a data table?
- in the first column
  - in the estimate column
  - in the second column
  - in the experiment column





**Directed Reading A *continued***

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**PATTERNS SHOWN BY GRAPHS**

**Match the correct definition with the correct term. Write the letter in the space provided.**

- |   |                           |
|---|---------------------------|
| _____ 16. a graph that shows the relationship between variables with a straight line                | <b>a.</b> nonlinear graph |
| _____ 17. a graph that cannot show the relationship between variables as a straight line            | <b>b.</b> linear graph    |
| _____ 18. a relationship in which the dependent variable and the independent variable both increase | <b>c.</b> direct          |
| _____ 19. a relationship in which one variable increases while the other variable decreases         | <b>d.</b> inverse         |

**Using Computers to Create Graphs**

**Write the letter of the correct answer in the space below.**

- \_\_\_\_\_ 20. Which of the following can help scientists organize data?
- a.** a theory
  - b.** a meterstick
  - c.** a computer
  - d.** a law

# Directed Reading A

## Section: Analyzing Your Data (pp. 56–61)

### WHY MATHEMATICS?

Write the letter of the correct answer in the space below.

- \_\_\_\_\_ 1. Which of the following is NOT a property that is determined by using mathematics?
- a. volume
  - b. texture
  - c. density
  - d. area
- \_\_\_\_\_ 2. Which of the following does mathematics help scientists to do?
- a. learn how to play musical instruments
  - b. travel to countries all over the world
  - c. summarize large amounts of data
  - d. learn foreign languages
- \_\_\_\_\_ 3. Which of the following is often called the “language of science”?
- a. mathematics
  - b. physics
  - c. biology
  - d. botany

### ACCURACY OF DATA

- \_\_\_\_\_ 4. Which of the following should you do to get accurate readings?
- a. Use incorrect tools.
  - b. Use tools correctly.
  - c. Use broken equipment.
  - d. Use tools incorrectly.

### Choosing Tools and Using Them Correctly

- \_\_\_\_\_ 5. Which of the following is the correct way to read liquid volume?
- a. Look at the bottom of the meniscus from a high angle.
  - b. Look at the top of the meniscus from a low angle.
  - c. Look at the top of the meniscus at eye level.
  - d. Look at the bottom of the meniscus at eye level.

**Directed Reading A *continued***

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**REPRODUCIBILITY OF DATA**

- \_\_\_\_\_ 6. Which of the following must happen in order for scientists to accept scientific data?
- a. The data must be reproducible.
  - b. The data cannot be reproducible.
  - c. The data must be based on a model.
  - d. The data must be shown on a graph.

**DESCRIBING THE ENTIRE SET OF DATA**

- \_\_\_\_\_ 7. How many data points must be added together to find the mean?
- a. all
  - b. one-third
  - c. one quarter
  - d. half
- \_\_\_\_\_ 8. Which of the following is best used when one data point is much smaller or much larger than the other data points?
- a. mean
  - b. median
  - c. mode
  - d. estimate
- \_\_\_\_\_ 9. Which of the following values occurs most often in a data set?
- a. mode
  - b. median
  - c. mean
  - d. estimate

**Use the terms from the following list to complete the sentences below.**

median                      mean                      mode

10. The number obtained by adding up the data for a given characteristic and dividing this sum by the number of individuals is called the \_\_\_\_\_.
11. The value of the middle item when data are arranged in order by size is called the \_\_\_\_\_.
12. The most frequently occurring value in a data set is called the \_\_\_\_\_.



# Vocabulary and Section Summary A

## Tools and Models in Science

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. mass

---

---

2. model

---

---

3. volume

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4. theory

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5. density

---

---

6. law

---

---

7. temperature

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## Vocabulary and Section Summary A *continued*

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### **SECTION SUMMARY**

**Read the following section summary.**

- Tools are used to make observations, take measurements, and analyze data.
- The International System of Units (SI) is the standard system of measurement.
- Length, mass, volume, density, and temperature are common measurements.
- A model uses familiar things to describe unfamiliar things.
- Physical, conceptual, and mathematical models are commonly used in science.
- A scientific theory is an explanation for many hypotheses and observations.

# Vocabulary and Section Summary A

## Organizing Your Data

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. independent variable

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2. dependent variable

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3. axis

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### SECTION SUMMARY

Read the following section summary.

- Scientists use data tables to organize information.
- Labels and units are important parts of data tables and graphs.
- The independent variable is the factor that the investigator changes.
- The dependent variable is the factor that the investigator measures.
- The line of best fit shows the trend of a linear graph.
- Graphs help show patterns, or trends, in data.
- Linear and nonlinear graphs show different relationships between variables.

# Vocabulary and Section Summary A

## Analyzing Your Data

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. mean

---

---

---

2. mode

---

---

---

3. median

---

---

---

4. slope

---

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---

### SECTION SUMMARY

Read the following section summary.

- Mathematics is an important tool for understanding and summarizing data.
- The accuracy and reproducibility of data used in scientific investigations affect the results.
- Mean, median, and mode summarize an entire set of data.
- Slope is the degree of slant of a straight line.
- The slope of a straight line represents a constant that can be used to understand and analyze data.
- Linear and nonlinear graphs result from different relationships in the data.



# Directed Reading A

## Section: What Is Matter? (pp. 78–83)

### MATTER

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What do humans, hot soup, and a neon sign have in common?
- They are brightly colored.
  - They are found in space.
  - They are made of matter.
  - They have the same volume.
- \_\_\_\_\_ 2. What has mass and takes up space?
- volume
  - matter
  - weight
  - space

### MATTER AND VOLUME

- \_\_\_\_\_ 3. What does the word *volume* refer to?
- an amount of matter
  - an effect of gravity
  - an amount of space
  - an effect of mass
- \_\_\_\_\_ 4. Why can't another CD fit in a rack once the rack is completely filled?
- because all the space is taken up
  - because the CD has mass
  - because space has three dimensions
  - because the rack has no volume

### Liquid Volume

- \_\_\_\_\_ 5. Which of the following units would be best for expressing the volume of water in a lake?
- grams (g)
  - liters (L)
  - meters (m)
  - milliliters (mL)

**Directed Reading A *continued***

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- \_\_\_\_\_ 6. Which of the following units would be best for expressing the volume of soda in a can?
- a. centimeters (cm)
  - b. grams (g)
  - c. liters (L)
  - d. milliliters (mL)

**Measuring the Volume of Liquids**

**Use the terms from the following list to complete the sentences below.**

cubic                                  meniscus                                  volume

7. To measure volume with a graduated cylinder, look at the bottom of the \_\_\_\_\_.
8. The volume of solid objects is usually expressed in \_\_\_\_\_ units.
9. To find the \_\_\_\_\_ of a regular solid, multiply its length, width, and height.

**Volume of an Irregularly Shaped Solid Object**

**Use the terms from the following list to complete the sentences below.**

irregular solid                          cubic centimeters                          milliliter (mL)

10. To find the volume of a(n) \_\_\_\_\_, measure the amount of water that the object displaces.
11. One cubic centimeter (1 cm<sup>3</sup>) is equal to one \_\_\_\_\_.
12. To express the volume of an irregular solid, you must change milliliters to \_\_\_\_\_.

**MATTER AND MASS**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 13. What is the measure of the amount of matter in an object?
- a. matter
  - b. mass
  - c. volume
  - d. weight

**Directed Reading A** *continued*

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- \_\_\_\_\_ 14. Which of the following is true about the mass of an object?
- a. Mass depends on the object's location.
  - b. Mass is a measure of gravity.
  - c. Mass does not depend on the object's location.
  - d. Mass depends in part on weight.
- \_\_\_\_\_ 15. How could you change the mass of an object?
- a. Move it to the moon.
  - b. Take some of its matter away.
  - c. Make Earth spin faster.
  - d. Change the object's weight.

**The Difference Between Mass and Weight**

- \_\_\_\_\_ 16. Which of the following is a measure of gravitational force?
- a. inertia
  - b. mass
  - c. volume
  - d. weight
- \_\_\_\_\_ 17. What is the force that keeps objects from floating into space called?
- a. mass
  - b. inertia
  - c. gravitational force
  - d. volume
- \_\_\_\_\_ 18. Which of the following is true about the weight of an object?
- a. Weight is measured with a balance.
  - b. Weight is the same on the moon as on Earth.
  - c. Weight is the same as mass.
  - d. Weight depends on location in the universe.

**Measuring Mass and Weight**

- \_\_\_\_\_ 19. What is the weight on Earth of an object with a mass of 100 g?
- a. 1 newton
  - b. 1 cm<sup>2</sup>
  - c. 1 mL
  - d. 1 kilogram

**Directed Reading A** *continued*

---

**Use the terms from the following list to complete the sentences below.**

newton

kilogram

mass

**20.** If a brick and a sponge have the same volume, the brick has

more \_\_\_\_\_.

**21.** The SI unit for mass is the \_\_\_\_\_.

**22.** The unit for weight is the SI unit for force called

the \_\_\_\_\_.

# Directed Reading A

## Section: Physical Properties (pp. 84–89)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which of the following kinds of questions would be most useful for identifying objects?
- a. questions about their properties
  - b. questions about their age
  - c. questions about their weight
  - d. questions about their volume

### IDENTIFYING PHYSICAL PROPERTIES

- \_\_\_\_\_ 2. What is a characteristic of an object that can be observed without changing the object's identity?
- a. a chemical property
  - b. a flexible property
  - c. a physical property
  - d. a measurable property

Match the correct example with the correct property. Write the letter in the space provided.

- |  |                 |
|--|-----------------|
| _____ 3. aluminum flattened into thin sheets of foil | a. ductility    |
| _____ 4. an ice cube made of solid water             | b. state        |
| _____ 5. copper pulled into thin wires               | c. malleability |

Match the correct example with the correct property. Write the letter in the space provided.

- |   |                         |
|---|-------------------------|
| _____ 6. flavored drink mix dissolving in water           | a. thermal conductivity |
| _____ 7. a rose smelling sweet                            | b. solubility           |
| _____ 8. a foam cup protecting your hand from a hot drink | c. odor                 |

**Directed Reading A *continued***

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**Density****Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 9. Which physical property is the amount of matter in a given space, or volume?
- a. density
  - b. ductility
  - c. state
  - d. weight
- \_\_\_\_\_ 10. If you know an object's mass ( $m$ ) and volume ( $V$ ), what equation would you use to find its density?
- a.  $D = m \times V$
  - b.  $D = \frac{m}{V}$
  - c.  $D = \frac{V}{m}$
  - d.  $D = V + m$
- \_\_\_\_\_ 11. Which of the following units are most often used for the density of a solid?
- a. g/mL
  - b.  $\text{m}^3/\text{kg}$
  - c.  $\text{N}/\text{cm}^3$
  - d.  $\text{g}/\text{cm}^3$

**Using Density to Identify Substances**

- \_\_\_\_\_ 12. Which of the following is true of the density of each substance in the table titled Densities of Common Substances?
- a. The density makes the substance heavy.
  - b. The density differs from the densities of other substances.
  - c. The density is different at different times.
  - d. The density is greater than the density of water.
- \_\_\_\_\_ 13. What is the density of lead shown in the table titled Densities of Common Substances?
- a.  $1.00 \text{ g}/\text{cm}^3$
  - b.  $0.0001663 \text{ g}/\text{cm}^3$
  - c.  $13.55 \text{ g}/\text{cm}^3$
  - d.  $11.35 \text{ g}/\text{cm}^3$
- \_\_\_\_\_ 14. Which substance in the table titled Densities of Common Substances is a liquid that has a density greater than that of water?
- a. mercury
  - b. ice
  - c. helium
  - d. lead

## Directed Reading A *continued*

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### Density of Solids

- \_\_\_\_\_ 15. How does the volume of a kilogram of lead compare with the volume of a kilogram of feathers?
- The lead has a larger volume.
  - The lead has a smaller volume.
  - The feathers have a smaller volume.
  - The volumes are the same.

### Density, Floating, and Sinking

- \_\_\_\_\_ 16. What happens to a solid object in water if its density is greater than water?
- The object floats on top.
  - The object dissolves.
  - The object floats in the middle.
  - The object sinks to the bottom.

### Liquid Layers

- \_\_\_\_\_ 17. What causes different liquids to form layers when they are poured into a container?
- the amounts of each liquid
  - differences in density
  - differences in color
  - the temperatures of the liquids
- \_\_\_\_\_ 18. Where is the least dense liquid found when liquids form layers?
- in the lightest-colored layer
  - in the middle layer
  - floating on the top
  - settled to the bottom

### PHYSICAL CHANGES: NO NEW SUBSTANCES

Use the terms from the following list to complete the sentences below.

identity

physical change

state

19. Any change in matter that changes only its physical form is called

a(n) \_\_\_\_\_.

20. All changes that cause a change of \_\_\_\_\_ are considered physical changes.

21. When silver is molded into a pendant, its \_\_\_\_\_ is the same.

**Directed Reading A *continued***

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**Examples of Physical Changes**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ **22.** Which of the following actions does NOT cause a purely physical change?
- a.** sanding a piece of wood
  - b.** burning a piece of wood
  - c.** dissolving sugar in water
  - d.** freezing water
- \_\_\_\_\_ **23.** Why is making ice from water a physical change?
- a.** The ice has some new properties.
  - b.** The ice floats on water.
  - c.** The water changes its state.
  - d.** The water changes its identity.

**Reversibility of Physical Changes**

- \_\_\_\_\_ **24.** Why are physical changes often easy to undo?
- a.** The identity of the substance changes.
  - b.** The substance disappears.
  - c.** The identity of the substance does not change.
  - d.** Two new substances are made.

**Matter and Physical Changes**

- \_\_\_\_\_ **25.** Why is making a star from a piece of paper considered a physical change?
- a.** The paper's state has changed.
  - b.** The paper's identity is the same.
  - c.** The paper's color is the same.
  - d.** The paper has aged.



## Skills Worksheet

**Directed Reading A****Section: Chemical Properties** (pp. 90–95)**IDENTIFYING CHEMICAL PROPERTIES**

Use the terms from the following list to complete the sentences below.

flammability

nonflammability

reactivity

chemical property

1. A property of matter that describes its ability to change into entirely new substances is called a(n) \_\_\_\_\_.
2. The ability of substances to change and form one or more new substances is a chemical property called \_\_\_\_\_.
3. The ability of a substance to burn is a chemical property known as \_\_\_\_\_.
4. Something that cannot burn has the property of \_\_\_\_\_.

**Comparing Physical and Chemical Properties**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 5. Which of the following sets of words describes only physical properties of a material?
- a. liquid, dense, flammable
  - b. solid, ductile, yellow
  - c. flammable, malleable, liquid
  - d. powdery, reactive, insoluble
- \_\_\_\_\_ 6. What chemical property causes rust to form on a nail?
- a. conductivity
  - b. nonflammability
  - c. reactivity with oxygen
  - d. flammability
- \_\_\_\_\_ 7. What do physical changes NOT change?
- a. the identity of the matter
  - b. the amount of matter
  - c. the state of matter
  - d. the volume of the sample
- \_\_\_\_\_ 8. What makes chemical properties hard to observe?
- a. They cause changes of state.
  - b. You can't see them until they produce new materials.
  - c. Wearing protective glasses is required.
  - d. They happen too quickly.

**Directed Reading A *continued***

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**Characteristic Properties**

- \_\_\_\_\_ 9. Which of these statements is true about characteristic properties of substances?
- a. They depend on sample size.
  - b. They can only be physical properties.
  - c. They can only be chemical properties.
  - d. They can be physical properties or chemical properties.

**CHEMICAL CHANGES AND NEW SUBSTANCES**

- \_\_\_\_\_ 10. Which of these phrases describes a chemical change?
- a. pouring milk into a glass
  - b. melting an ice cube
  - c. digesting food in your body
  - d. bending an iron nail

**Use the terms from the following list to complete the sentences below.**

change

property

11. A chemical \_\_\_\_\_ describes which changes can happen to a substance.
12. A chemical \_\_\_\_\_ is a process by which substances actually change into new substances.

**What Happens During a Chemical Change?****Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 13. Which of the following is an example of a chemical change?
- a. sugar dissolving
  - b. a cake baking
  - c. chocolate melting
  - d. water freezing
- \_\_\_\_\_ 14. Which of the following describes what happens to the substances involved in a chemical change?
- a. The substances keep their identities.
  - b. The substances change in form.
  - c. The substances change into new substances with different properties.
  - d. The substances combine and mix.

## Directed Reading A *continued*

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### Signs of Chemical Changes

- \_\_\_\_\_ 15. Which of the following usually happens during a chemical change?
- a. Heat is released or absorbed.
  - b. The state of the matter changes.
  - c. The identity of the matter stays the same.
  - d. No heat is released or absorbed.

### Matter and Chemical Changes

- \_\_\_\_\_ 16. Why are chemical changes difficult to reverse?
- a. because they involve physical changes
  - b. because they change the matter's form
  - c. because they change the identity of the matter
  - d. because their products are hard to find

### PHYSICAL VERSUS CHEMICAL CHANGES

- \_\_\_\_\_ 17. What is the type and the arrangement of the matter in an object called?
- a. the physical properties of the object
  - b. the reactivity of the object
  - c. the flammability of the object
  - d. the composition of the object
- \_\_\_\_\_ 18. How does a physical change differ from a chemical change?
- a. The change is not reversible.
  - b. The composition of the matter is unchanged.
  - c. New properties of the matter are created.
  - d. New materials are produced.
- \_\_\_\_\_ 19. What do chemical changes in a substance alter?
- a. the state of the substance
  - b. the composition of the substance
  - c. the size of the substance
  - d. nothing in the substance

### Reversing Changes

- \_\_\_\_\_ 20. Why are chemical changes difficult to reverse?
- a. because they involve changes in composition
  - b. because they involve changes in form
  - c. because they involve changes in state
  - d. because the temperature increases

# Vocabulary and Section Summary A

## What Is Matter?

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. matter

---

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2. volume

---

---

3. meniscus

---

---

4. mass

---

---

5. weight

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### SECTION SUMMARY

Read the following section summary.

- Two properties of matter are volume and mass.
- Volume is the amount of space taken up by an object.
- Mass is a measure of the amount of matter in an object.
- The SI unit of volume is the liter (L). The SI unit of mass is the kilogram (kg).
- Weight is a measure of the gravitational force on an object, usually in relation to Earth. Weight is expressed in newtons (N).

# Vocabulary and Section Summary A

## Physical Properties

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. physical property

---

---

---

2. density

---

---

---

3. physical change

---

---

---

### SECTION SUMMARY

Read the following section summary.

- Physical properties of matter can be observed without changing the identity of the matter.
- Examples of physical properties are melting temperature, density, hardness, thermal conductivity, and electrical conductivity.
- Density is the amount of matter in a given space.
- Density can be used to identify substances because the density of a substance is constant at a given pressure and temperature.
- When a substance undergoes a physical change, its identity stays the same.
- Physical changes include dissolving, cutting, bending, freezing, and melting.

# Vocabulary and Section Summary A

## Chemical Properties

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. chemical property

---

---

---

2. chemical change

---

---

---

### SECTION SUMMARY

Read the following section summary.

- Chemical properties describe the ability of a substance to change into a new substance.
- The chemical properties of a substance describe how the substance will behave under conditions that favor a chemical change.
- Reactivity and flammability are chemical properties.
- New substances form as a result of a chemical change.
- Chemical changes usually liberate or absorb heat.
- Chemical changes alter the composition of a substance.

# Directed Reading A

## Section: Four States of Matter (pp. 110–113)

### MATTER: MOVING PARTICLES

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What are solids, liquids, and gases examples of?
- plasmas
  - states of matter
  - atoms
  - molecules
- \_\_\_\_\_ 2. Which of the following is true of the particles that make up matter?
- They are in constant motion.
  - They only move in solids.
  - They only move in liquids.
  - They only move in gases.

Match the correct description with the correct term. Write the letter in the space provided.

- \_\_\_\_\_ 3. Particles vibrate in place. a. solid
- \_\_\_\_\_ 4. Particles move independently. b. liquid
- \_\_\_\_\_ 5. Particles are loosely connected. c. gas

### SOLIDS

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 6. What stays the same in solids?
- shape and volume
  - color and shape
  - position and shape
  - state and volume

### LIQUIDS

- \_\_\_\_\_ 7. Which statement is true of liquids?
- They have a fixed shape but not a fixed volume.
  - They have a fixed shape and a fixed volume.
  - They have a fixed volume but not a fixed shape.
  - They do not have a fixed shape or volume.

**Directed Reading A *continued***

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- \_\_\_\_\_ 8. What happens to the volume of a liquid poured into a larger container?
- a. It increases.
  - b. It decreases.
  - c. It stays the same.
  - d. It increases and then decreases.

**GASES**

- \_\_\_\_\_ 9. Which of the following states of matter has no fixed shape or volume and does not conduct electricity?
- a. gas
  - b. liquid
  - c. solid
  - d. plasma
- \_\_\_\_\_ 10. What is true of the particles of a gas?
- a. They are very close together.
  - b. They are always far apart.
  - c. They slide past each other.
  - d. They move freely and collide randomly.
- \_\_\_\_\_ 11. Why can a small tank of helium gas fill many balloons?
- a. because the amount of empty space between the particles can change
  - b. because helium is a liquid
  - c. because balloons are solid
  - d. because the particles of helium in the tank are farther apart than particles in the balloon

**PLASMAS**

- \_\_\_\_\_ 12. What is the most common state of matter in the universe?
- a. plasma
  - b. solid
  - c. liquid
  - d. gas
- \_\_\_\_\_ 13. Which of the following properties of plasma is different from gases?
- a. no definite shape
  - b. no definite volume
  - c. particles move freely
  - d. conducts electric current
- \_\_\_\_\_ 14. How can artificial plasmas be formed?
- a. by passing electric charges through solids
  - b. by passing electric charges through liquids
  - c. by passing electric charges through gases
  - d. by passing electric charges through plasmas



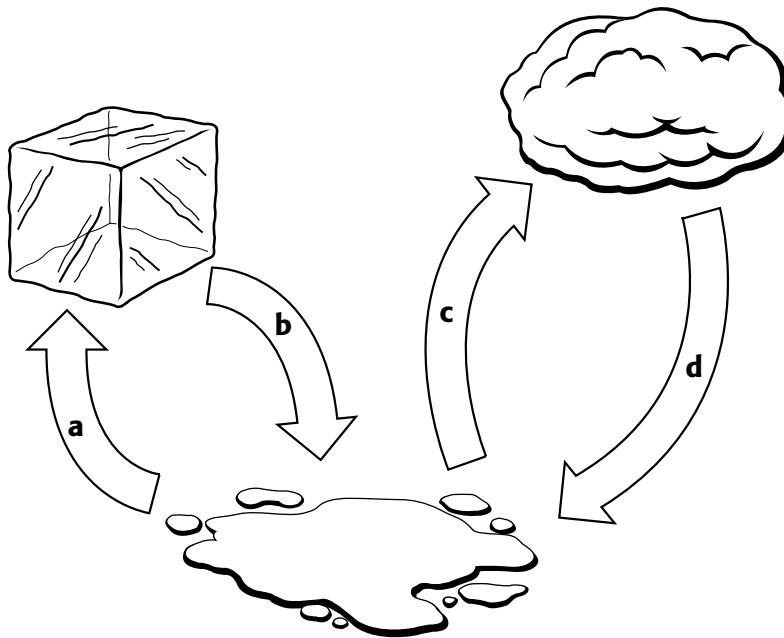
## Skills Worksheet

**Directed Reading A****Section: Changes of State** (pp. 114–119)**ENERGY AND CHANGES OF STATE**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What kind of change is a change of state?
- a. a chemical change
  - b. a change in the identity of a substance
  - c. a physical and chemical change
  - d. a physical change
- \_\_\_\_\_ 2. Which of the following is NOT true?
- a. Particles move differently depending on state.
  - b. Energy must be added or removed to change state.
  - c. Particles have the same amount of energy in different states.
  - d. Particles have different amounts of energy in different states.

Match the labels to the graphic. Write the letter in the space provided.



- \_\_\_\_\_ 3. freezing
- \_\_\_\_\_ 4. evaporation
- \_\_\_\_\_ 5. condensation
- \_\_\_\_\_ 6. melting

**Directed Reading A *continued***

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**MELTING: SOLID TO LIQUID**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 7. What is a change in state from a solid to a liquid?
- a. freezing
  - b. melting
  - c. evaporation
  - d. sublimation

**Melting Point**

- \_\_\_\_\_ 8. What is the temperature at which a solid changes to a liquid called?
- a. melting point
  - b. boiling point
  - c. freezing point
  - d. evaporation point

**Adding Energy**

- \_\_\_\_\_ 9. What must be absorbed for a solid to melt?
- a. water
  - b. atoms
  - c. energy
  - d. molecules

**FREEZING: LIQUID TO SOLID**

- \_\_\_\_\_ 10. What is the change in state from a liquid to a solid called?
- a. evaporation
  - b. melting
  - c. sublimation
  - d. freezing

**Removing Energy**

- \_\_\_\_\_ 11. Which of the following is the same as the freezing point of an object?
- a. its melting point
  - b. its evaporation point
  - c. its sublimation point
  - d. its boiling point

**Directed Reading A *continued***

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**EVAPORATION: LIQUID TO GAS**

- \_\_\_\_\_ 12. Which of the following is the change in state from a liquid to a gas?
- a. melting
  - b. freezing
  - c. sublimation
  - d. evaporation

**Evaporation and Boiling**

- \_\_\_\_\_ 13. Which of the following is the conversion of liquid to vapor throughout the liquid?
- a. boiling
  - b. freezing
  - c. sublimation
  - d. evaporation
- \_\_\_\_\_ 14. When water is boiling, which of the following does NOT happen?
- a. Molecular motion increases.
  - b. Molecular motion decreases.
  - c. Water molecules overcome attraction.
  - d. Water vapor escapes.

**Effects of Pressure on Boiling Point**

- \_\_\_\_\_ 15. What happens to the boiling point of a substance as you go higher above sea level?
- a. The boiling point gets higher.
  - b. The boiling point stays the same.
  - c. The boiling point gets lower.
  - d. The substance won't boil.

**CONDENSATION: GAS TO LIQUID**

- \_\_\_\_\_ 16. What is condensation?
- a. the change of state from a liquid to a gas
  - b. the change of state from a solid to a gas
  - c. the change of state from a gas to a solid
  - d. the change of state from a gas to a liquid
- \_\_\_\_\_ 17. Which of the following must happen for gas to become a liquid?
- a. Small numbers of particles must clump together.
  - b. Large numbers of particles must spread apart.
  - c. Large numbers of particles must clump together.
  - d. Small numbers of particles must spread apart.

**Directed Reading A *continued***

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**SUBLIMATION: SOLID TO GAS**

- \_\_\_\_\_ **18.** Dry ice changes from a solid to a gas during what process?
- a.** melting
  - b.** freezing
  - c.** boiling
  - d.** sublimation
- \_\_\_\_\_ **19.** What happens to the particles of a substance during sublimation?
- a.** They spread far apart.
  - b.** They clump close together.
  - c.** They lose energy.
  - d.** They maintain the same energy.

**TEMPERATURE AND CHANGES OF STATE**

- \_\_\_\_\_ **20.** What happens when the temperature of a substance changes?
- a.** The speed of the particles stays the same.
  - b.** The speed of the particles changes.
  - c.** The substance always melts.
  - d.** The substance always freezes.

# Vocabulary and Section Summary A

## Four States of Matter

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. states of matter

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2. solid

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3. liquid

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4. gas

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5. plasma

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### SECTION SUMMARY

Read the following section summary.

- Particles of matter are in constant motion. The states of matter depend on the motion of particles.
- A solid has a definite shape and volume. A liquid has a definite volume but not a definite shape.
- A gas does not have a definite volume or shape. Plasma, a fourth state of matter, does not have a definite shape or volume, and its particles are broken apart.

# Vocabulary and Section Summary A

## Changes of State

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. change of state

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2. melting

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3. evaporation

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4. boiling

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5. condensation

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6. sublimation

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## Vocabulary and Section Summary A *continued*

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### SECTION SUMMARY

Read the following section summary.

- A change of state is the conversion of a substance from one physical form to another.
- A change of state requires a loss or gain of energy by a substance's particles.
- Melting is the change from a solid to a liquid, and freezing is the change from a liquid to a solid.
- Both boiling and evaporation result in a liquid changing to a gas.
- Condensation is the change of a gas to a liquid. It is the reverse of evaporation.
- Sublimation changes a solid directly to a gas.
- The temperature of a substance does not change during a change of state.

## Skills Worksheet

**Directed Reading A****Section: Elements** (pp. 134–137)**ELEMENTS, THE SIMPLEST SUBSTANCES**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. A pure substance that cannot be broken down into simpler substances by physical or chemical means is called what?
- a material
  - a mixture
  - an element
  - a chemical

**Only One Kind of Atom**

- \_\_\_\_\_ 2. What is a substance in which all of the “building-block” particles are identical called?
- an element
  - a pure substance
  - a mineral
  - a solution
- \_\_\_\_\_ 3. Which of the following are the building-block particles for elements?
- atoms
  - electrons
  - protons
  - neutrons

**CLASSIFYING ELEMENTS**

- \_\_\_\_\_ 4. Which of the following is NOT a physical property of an element?
- reactivity
  - hardness
  - melting point
  - density
- \_\_\_\_\_ 5. Why does a helium-filled balloon float up when you let go?
- Helium is more dense than air.
  - Helium is less dense than air.
  - Krypton is less dense than helium.
  - Air is less dense than helium.



**Directed Reading A *continued***

**Identifying Elements by Their Properties**

**Match the correct description with the correct term. Write the letter in the space provided.**

- |  |                        |
|--|------------------------|
| _____ 6. is a characteristic chemical property of elements | <b>a.</b> element      |
| _____ 7. can be identified by its unique properties        | <b>b.</b> flammability |
| _____ 8. combines with oxygen to form rust                 | <b>c.</b> iron         |
| _____ 9. has a melting point of 1,495°C                    | <b>d.</b> cobalt       |

**GROUPING ELEMENTS**

**Categories of Elements**

**Use the terms from the following list to complete the sentences below.**

- |           |            |
|-----------|------------|
| nonmetals | metals     |
| elements  | metalloids |

- 10.** All \_\_\_\_\_ are either metals, metalloids, or nonmetals.
- 11.** Elements that are shiny and conduct heat and electric current are \_\_\_\_\_.
- 12.** Elements that are poor conductors of heat are \_\_\_\_\_.
- 13.** Elements with properties of both metals and nonmetals are called \_\_\_\_\_.

**Categories Are Similar**

**Match the correct description with the correct term. Write the letter in the space provided.**

- |   |                                     |
|---|-------------------------------------|
| _____ 14. elements that are malleable                 | <b>a.</b> characteristic properties |
| _____ 15. traits that identify elements in a category | <b>b.</b> semimetals                |
| _____ 16. another name for metalloids                 | <b>c.</b> metals                    |
| _____ 17. elements that are dull                      | <b>d.</b> nonmetals                 |

**Directed Reading A** *continued*

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**Match the correct description with the correct term. Write the letter in the space provided.**

\_\_\_\_\_ **18.** iodine, sulfur, neon

\_\_\_\_\_ **19.** lead, copper, tin

\_\_\_\_\_ **20.** silicon, boron, antimony

**a.** nonmetals

**b.** metalloids

**c.** metals

## Skills Worksheet

**Directed Reading A****Section: Compounds** (pp. 138–141)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which of the following substances is a compound?
- a. oxygen
  - b. magnesium
  - c. water
  - d. copper

**COMPOUNDS: MADE OF ELEMENTS**

- \_\_\_\_\_ 2. What kind of substance is composed of two or more elements that are chemically combined?
- a. an element
  - b. a compound
  - c. a mixture
  - d. a particle
- \_\_\_\_\_ 3. Which of the following elements combine to form the compound citric acid?
- a. hydrogen and oxygen
  - b. carbon and oxygen
  - c. hydrogen, carbon, and oxygen
  - d. sodium, hydrogen, carbon, and oxygen

**Chemical Reactions Form Compounds**

- \_\_\_\_\_ 4. Which of the following is the process by which substances change into new substances?
- a. a chemical reaction
  - b. a chain reaction
  - c. a physical reaction
  - d. an atomic reaction

**PROPERTIES OF COMPOUNDS**

- \_\_\_\_\_ 5. Which of the following statements about compounds is true?
- a. All compounds react with acid.
  - b. Each compound has its own physical properties.
  - c. Compounds are used to identify elements.
  - d. Compounds are similar to elements.

## Directed Reading A *continued*

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### Properties: Compounds Versus Elements

- \_\_\_\_\_ 6. Why are we able to eat sodium and chlorine in a compound?
- Sodium reacts violently with calcium.
  - Chlorine is table salt.
  - The compound is harmless.
  - Sodium is a metal.

### The Ratio of Elements in a Compound

- \_\_\_\_\_ 7. How do elements join to form compounds?
- never in the same ratio
  - in a specific mass ratio
  - randomly
  - in a 1:8 mass ratio

### BREAKING DOWN COMPOUNDS

Use the terms from the following list to complete the sentences below.

carbonic acid                      chemical change                      carbon dioxide

8. The compound that helps give some drinks “fizz” is called \_\_\_\_\_.
9. When you open a soft drink, carbonic acid breaks down into \_\_\_\_\_ and water.
10. The only way to break down compounds is through a(n) \_\_\_\_\_.

### COMPOUNDS IN YOUR WORLD

#### Compounds in Industry

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 11. Which of the following compounds is broken down to make aluminum?
- mercury oxide
  - aluminum oxide
  - aluminum chloride
  - magnesium oxide

**Directed Reading A *continued***

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**Compounds in Nature**

- \_\_\_\_\_ **12.** Which of the following can form compounds from nitrogen in the air?
- a.** bacteria
  - b.** pea plants
  - c.** animals
  - d.** all plants
- \_\_\_\_\_ **13.** What type of compound do plants and animals use to make proteins?
- a.** sugar
  - b.** ammonia
  - c.** carbon dioxide
  - d.** nitrogen compounds
- \_\_\_\_\_ **14.** What do plants use during photosynthesis to make carbohydrates?
- a.** soil
  - b.** carbon dioxide
  - c.** carbon monoxide
  - d.** oxygen

## Skills Worksheet

**Directed Reading A****Section: Mixtures** (pp. 142–147)**PROPERTIES OF MIXTURES**

Use the terms from the following list to complete the sentences below.

mixture

compound

physical

identity

1. A combination of substances that are not chemically combined is called a(n) \_\_\_\_\_.
2. Two or more materials that combine chemically form a(n) \_\_\_\_\_.
3. In a mixture, the \_\_\_\_\_ of the substances doesn't change.
4. Mixtures can be separated through \_\_\_\_\_ changes.

**Separating Mixtures Through Physical Methods**

Match the correct description with the correct term. Write the letter in the space provided.

- |  |                 |
|--|-----------------|
| _____ 5. used to separate crude oil                      | a. distillation |
| _____ 6. used to separate a mixture of aluminum and iron | b. centrifuge   |
| _____ 7. used to separate the parts of blood             | c. filter       |
| _____ 8. used to separate sulfur and table salt          | d. magnet       |

**The Ratio of Components in a Mixture**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 9. Which of the following affects the color of granite?
- a. ratio of minerals
  - b. amount of mixture
  - c. temperatures of mixture
  - d. weight of minerals

**Directed Reading A *continued***

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**SOLUTIONS**

- \_\_\_\_\_ 10. Which of the following is NOT true of solutions?
- a. They contain a solute.
  - b. They contain evenly mixed substances.
  - c. They contain a solvent.
  - d. They look like two substances.
- \_\_\_\_\_ 11. When substances separate and spread evenly throughout a mixture, what is the process called?
- a. solute
  - b. dissolving
  - c. chemical change
  - d. solubility
- \_\_\_\_\_ 12. What is the substance that is dissolved in a solution called?
- a. solute
  - b. solvent
  - c. compound
  - d. mixture
- \_\_\_\_\_ 13. In a solution, what is the substance in which something dissolves called?
- a. solute
  - b. solvent
  - c. compound
  - d. mixture

**Use the terms from the following list to complete the sentences below.**

solvent                      particles                      alloy  
soluble                      solution

14. Salt is \_\_\_\_\_ in water because it dissolves in water.
15. In a solution of two gases, the substance that is present in the largest amount is called the \_\_\_\_\_.
16. A solid solution of metals or nonmetals dissolved in metal is called a(n) \_\_\_\_\_.
17. A solution contains many small \_\_\_\_\_.
18. The particles in a(n) \_\_\_\_\_ are so small that they don't scatter light.





**Directed Reading A** *continued*

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**Use the terms from the following list to complete the sentences below.**

temperature

solubility

- 24.** The ability of one substance to dissolve in another at a given temperature and pressure is called \_\_\_\_\_.
- 25.** In a solution, the \_\_\_\_\_ usually affects the solubility.

# Vocabulary and Section Summary A

## Elements

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. element

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2. pure substance

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3. metal

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4. nonmetal

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5. metalloid

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### SECTION SUMMARY

Read the following section summary.

- A substance in which all of the particles are alike is a pure substance.
- An element is a pure substance that cannot be broken down into anything simpler by physical or chemical means.
- Each element has a unique set of physical and chemical properties.
- Elements are classified as metals, nonmetals, or metalloids, based on their properties.

# Vocabulary and Section Summary A

## Compounds

### VOCABULARY

In your own words, write a definition of the following term in the space provided.

1. compound

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### SECTION SUMMARY

Read the following section summary.

- A compound is a pure substance composed of two or more elements.
- During a chemical reaction, the atoms of two or more elements react with each other to form molecules of compounds.
- Each compound has unique physical and chemical properties that differ from those of the elements that make up the compound.
- Compounds can be broken down into simpler substances only by chemical changes.

# Vocabulary and Section Summary A

## Mixtures

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. mixture

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2. solution

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3. solute

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4. solvent

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5. concentration

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6. solubility

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## Vocabulary and Section Summary A *continued*

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### SECTION SUMMARY

Read the following section summary.

- A mixture is a combination of two or more substances, each of which keeps its own characteristics.
- Mixtures can be separated by physical means, such as filtration and evaporation.
- A solution is a mixture that appears to be a single substance but is composed of a solute dissolved in a solvent.
- Concentration is a measure of the amount of solute dissolved in a given amount of solvent.
- The solubility of a solute is the ability of the solute to dissolve in a solvent at a certain temperature.

## Directed Reading A

### Section: Development of the Atomic Theory (pp. 164–171)

#### THE BEGINNING OF ATOMIC THEORY

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Around 440 BCE, who thought that matter is made of particles that cannot be cut?
- Bohr
  - Dalton
  - Aristotle
  - Democritus
- \_\_\_\_\_ 2. What does the word *atom* mean?
- dividable
  - invisible
  - hard particles
  - not able to be divided
- \_\_\_\_\_ 3. What is the smallest particle into which an element can be divided?
- a nucleus
  - a proton
  - an atom
  - a neutron

#### DALTON'S ATOMIC THEORY BASED ON EXPERIMENTS

- \_\_\_\_\_ 4. Which of the following ideas was part of Dalton's atomic theory?
- All substances are made of atoms.
  - Atoms can be divided.
  - Atoms can be destroyed.
  - Some substances are made of atoms.
- \_\_\_\_\_ 5. What happened to Dalton's theory in the late 1800s?
- Dalton's theory was ignored.
  - Dalton's theory was disproved.
  - Dalton's theory was proved.
  - Dalton's theory was changed.

#### THOMSON'S DISCOVERY OF ELECTRONS

- \_\_\_\_\_ 6. What did Thomson discover about atoms?
- Atoms cannot be divided.
  - There are small particles inside atoms.
  - There are no small particles in atoms.
  - All atoms have negative charges.

**Directed Reading A *continued***

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**Use the terms from the following list to complete the sentences below.**

electrons                      particles                      positively

7. Thomson discovered that a(n) \_\_\_\_\_ charged plate in a cathode-ray tube attracted an invisible beam.

8. Thomson concluded that the beam was made of \_\_\_\_\_ that have negative electric charges.

9. The negatively charged particles Thomson discovered are called \_\_\_\_\_.

\_\_\_\_\_ 10. Which of the following is true according to Thomson's plum-pudding model?

- a. Electrons are mixed throughout an atom.
- b. Electrons are in the center of an atom.
- c. Electrons are positively charged.
- d. Electrons are absent from an atom.

**RUTHERFORD'S ATOMIC "SHOOTING GALLERY"**

\_\_\_\_\_ 11. What did Rutherford expect all the charged particles to do?

- a. to pass right through the gold foil
- b. to deflect to the sides of the gold foil
- c. to bounce straight back
- d. to become "blobs" of matter

\_\_\_\_\_ 12. Which of the following statements is NOT true of Rutherford's results?

- a. Some of the particles turned to one side.
- b. Some of the particles did not move.
- c. Most of the particles passed through the gold foil.
- d. Some of the particles bounced straight back.

**THE NUCLEUS AND THE ELECTRONS**

\_\_\_\_\_ 13. What did Rutherford revise in 1911?

- a. the atomic theory
- b. the particle theory
- c. the electron theory
- d. the scientific theory

### Directed Reading A *continued*

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- \_\_\_\_\_ 14. What positively charged area did Rutherford believe was in the center of an atom?
- a. an electron
  - b. a nucleus
  - c. a particle
  - d. a proton
- \_\_\_\_\_ 15. What important idea emerged from the results of Rutherford's experiment?
- a. Atoms are mostly empty space with no nucleus.
  - b. Atoms are mostly electrons.
  - c. Atoms are mostly empty space with a tiny, massive nucleus.
  - d. Atoms have electrons in the nucleus.

#### Bohr's Electron Levels

- \_\_\_\_\_ 16. How did Bohr propose that electrons move around the nucleus?
- a. in a variety of ways
  - b. haphazardly
  - c. between the levels
  - d. in definite paths

#### The Modern Atomic Theory

- \_\_\_\_\_ 17. What model represents current atomic theory?
- a. electron-cloud model
  - b. plum-pudding model
  - c. Rutherford's model
  - d. Bohr's model
- \_\_\_\_\_ 18. What is an atom's electron cloud?
- a. a region where electrons are never found
  - b. a region where protons are likely to be found
  - c. a region where neutrons are likely to be found
  - d. a region where electrons are likely to be found

#### Energy Levels

- \_\_\_\_\_ 19. What is each electron's definite energy based on?
- a. its weight
  - b. its size
  - c. its location around the nucleus
  - d. its location inside the nucleus



**Directed Reading A *continued***

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**THE SIZE OF AN ATOM**

- \_\_\_\_\_ **20.** Which of the following statements is true?
- a.** A penny has about 20,000 atoms.
  - b.** A penny has more atoms than Earth has people.
  - c.** Aluminum is made up of large-sized atoms.
  - d.** Aluminum atoms have a diameter of about 3 cm.

**Observing Atoms**

- \_\_\_\_\_ **21.** Which of the following tools do scientists now use to observe atoms?
- a.** light waves
  - b.** a scanning tunneling electron microscope
  - c.** a telescope
  - d.** a camera

## Skills Worksheet

**Directed Reading A****Section: The Atom** (pp. 172–179)**THE PARTS OF AN ATOM****Subatomic Particles**

- \_\_\_\_\_ 1. Why are protons, neutrons, and electrons called *subatomic particles*?
- because they are much smaller than an atom
  - because they are much larger than an atom
  - because they are not part of an atom
  - because they are mostly empty space

**The Nucleus**

- \_\_\_\_\_ 2. What two particles make up an atom's nucleus?
- atomic mass units and electrons
  - protons and electrons
  - protons and neutrons
  - electrons and neutrons

**Match the correct description with the correct term. Write the letter in the space provided.**

- |  |                            |
|--|----------------------------|
| _____ 3. unit of mass that describes the mass of an atom | <b>a.</b> electron         |
| _____ 4. particle with no electrical charge              | <b>b.</b> nucleus          |
| _____ 5. particle that is positively charged             | <b>c.</b> proton           |
| _____ 6. particle that is negatively charged             | <b>d.</b> neutron          |
| _____ 7. part that contains most of the mass of an atom  | <b>e.</b> atomic mass unit |

**Outside the Nucleus**

- \_\_\_\_\_ 8. How does the mass of an electron compare to the mass of protons and neutrons?
- It is much larger.
  - It is the same.
  - It is much smaller.
  - It is unknown.

**Directed Reading A *continued***

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**ATOMS AND ELEMENTS**

Use the terms from the following list to complete the sentences below.

helium                      hydrogen                      electron

9. The simplest atom has one proton and one \_\_\_\_\_.
10. The simplest atom is the \_\_\_\_\_ atom.
11. If you build an atom using two protons, two neutrons, and two electrons, you have built an atom of \_\_\_\_\_.

Use the terms from the following list to complete the sentences below.

periodic table                      atomic number  
neutrons                              element

12. An atom does not have to have equal numbers of protons and \_\_\_\_\_.
13. The number of protons in the nucleus of an atom is the \_\_\_\_\_ of that atom.
14. All atoms of a(n) \_\_\_\_\_ have the same atomic number.
15. The atomic number of each element is listed on the \_\_\_\_\_.

**ISOTOPES**

- \_\_\_\_\_ 16. What do isotopes always have?
- a. the same number of protons
  - b. the same number of neutrons
  - c. a different atomic number
  - d. the same mass
- \_\_\_\_\_ 17. How are isotopes of the same element different?
- a. They have different numbers of protons.
  - b. They have different numbers of neutrons.
  - c. They have different numbers of electrons.
  - d. They have different numbers of ions.

**Directed Reading A *continued***

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**Properties of Isotopes**

- \_\_\_\_\_ **18.** Which phrase best describes radioactive isotopes?
- a.** They are stable.
  - b.** They never change.
  - c.** They are unstable.
  - d.** They don't produce energy.

**The Difference Between Isotopes**

- \_\_\_\_\_ **19.** What is an atom's mass number?
- a.** the sum of the protons and neutrons in the nucleus
  - b.** the sum of the protons and electrons in the nucleus
  - c.** the sum of the neutrons and electrons in the nucleus
  - d.** the number of electrons in the nucleus
- \_\_\_\_\_ **20.** What is the mass number of an isotope that has 5 protons, 6 neutrons, and 5 electrons?
- a.** 1
  - b.** 11
  - c.** 10
  - d.** 16

**Naming Isotopes**

- \_\_\_\_\_ **21.** What is the name of a carbon isotope that has a mass number of 12?
- a.** carbon-8
  - b.** carbon-12
  - c.** carbon-6
  - d.** carbon-18

**Isotopes and Atomic Mass**

- \_\_\_\_\_ **22.** What is the weighted average of the masses of all the naturally occurring isotopes of an element called?
- a.** atomic number
  - b.** mass number
  - c.** isotope mass
  - d.** atomic mass

**Directed Reading A *continued***

---

**FORCES IN ATOMS**

**Use the terms from the following list to complete the sentences below.**

strong force

electromagnetic force

weak force

gravitational force

**23.** Protons stay together in the nucleus because of

\_\_\_\_\_.

**24.** Objects are pulled toward one another because of

\_\_\_\_\_.

**25.** An important force in radioactive atoms is the

\_\_\_\_\_.

**26.** The electrons are held around the nucleus because

of \_\_\_\_\_.

# Vocabulary and Section Summary A

## Development of the Atomic Theory

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. atom

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2. electron

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3. nucleus

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4. electron cloud

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### SECTION SUMMARY

Read the following section summary.

- Democritus thought that matter is composed of atoms.
- Dalton based his theory on observations of how elements combine.
- Thomson discovered electrons in atoms.
- Rutherford discovered that atoms are mostly empty space with a dense, positive nucleus.
- Bohr proposed that electrons are located in levels at certain distances from the nucleus.
- The electron-cloud model represents the current atomic theory.
- Atoms are extremely tiny, but scanning tunneling electron microscopes can be used to form direct images of them.

# Vocabulary and Section Summary A

## The Atom

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. proton

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2. atomic mass unit

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---

3. neutron

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4. atomic number

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---

5. isotope

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---

6. mass number

---

---

7. atomic mass

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## Vocabulary and Section Summary A *continued*

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### SECTION SUMMARY

Read the following section summary.

- Atoms consist of a nucleus, which has protons and usually neutrons, and electrons, which are located in electron clouds around the nucleus.
- The number of protons in the nucleus of an atom is that atom's atomic number. All atoms of an element have the same atomic number.
- Different isotopes of an element have different numbers of neutrons in their nuclei. Isotopes of an element share most chemical and physical properties.
- The mass number of an atom is the sum of the atom's neutrons and protons.
- Atomic mass is a weighted average of the masses of all natural isotopes of an element.
- The forces at work in an atom are gravitational force, electromagnetic force, strong force, and weak force.



# Directed Reading A

## Section: Arranging the Elements (pp. 194–201)

### DISCOVERING A PATTERN

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. How did Dmitri Mendeleev, the Russian chemist, arrange the elements?
- in order of increasing density
  - in order of increasing melting point
  - in order of increasing shine
  - in order of increasing atomic mass

### Periodic Properties of the Elements

- \_\_\_\_\_ 2. What does *periodic* mean?
- occurs or repeats at regular intervals
  - occurs almost never
  - occurs only once
  - occurs once or twice
- \_\_\_\_\_ 3. Mendeleev's pattern repeated after how many elements?
- every two elements
  - every three elements
  - every seven elements
  - every five elements
- \_\_\_\_\_ 4. What did Mendeleev's table become known as?
- the periodic graph of the elements
  - the periodic table of the elements
  - the table of periodic elements
  - the chart of periodic elements

### Predicting Properties of Missing Elements

- \_\_\_\_\_ 5. How did Mendeleev predict the properties of missing elements?
- by making the properties up
  - by ignoring the properties of found elements
  - by using the pattern he found
  - by not following the pattern

**Directed Reading A *continued***

---

**CHANGING THE ARRANGEMENT**

- \_\_\_\_\_ 6. Which of the following did the British scientist Henry Moseley determine?
- a. the atomic number of an atom
  - b. the atomic mass of an atom
  - c. the number of atoms in a proton
  - d. the periodic table of elements
- \_\_\_\_\_ 7. How are the elements arranged horizontally on the periodic table?
- a. by similar chemical properties
  - b. by atomic mass
  - c. in order of increasing atomic number
  - d. in order of decreasing atomic number

**PERIODIC TABLE OF THE ELEMENTS**

- \_\_\_\_\_ 8. Which of the following items is NOT included in each square of the periodic table in your text?
- a. atomic number
  - b. chemical symbol
  - c. melting point
  - d. atomic mass
- \_\_\_\_\_ 9. On the periodic table in your text, what color indicates an element is a solid?
- a. red
  - b. blue
  - c. green
  - d. yellow

**THE PERIODIC TABLE AND CLASSES OF ELEMENTS**

Use the terms from the following list to complete the sentences below.

nonmetals  
metals

semimetals  
periodic table

10. Most of the elements in the \_\_\_\_\_ are metals.
11. More than half of the \_\_\_\_\_ are gases at room temperature.
12. All \_\_\_\_\_ are good conductors of electric current.
13. Metalloids are also called \_\_\_\_\_.

**Directed Reading A *continued***

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**DECODING THE PERIODIC TABLE****Chemical Symbols**

Use the terms from the following list to complete the sentences below.

chemical symbol

californium

mendelevium

14. Some elements, such as \_\_\_\_\_, are named after scientists.
15. Some elements, such as \_\_\_\_\_, are named after places.
16. For most elements, the \_\_\_\_\_ has one or two letters, the first of which is always capitalized.

**Periods**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 17. What is each horizontal row of elements on the periodic table called?
- a. a group
  - b. a period
  - c. a family
  - d. a property
- \_\_\_\_\_ 18. In what direction do you read periods?
- a. from top to bottom
  - b. from bottom to top
  - c. from left to right
  - d. from right to left
- \_\_\_\_\_ 19. What kind of pattern do properties of elements in a row follow?
- a. a musical pattern
  - b. a square pattern
  - c. a repeating, or periodic, pattern
  - d. a star-shaped pattern

**Groups**

- \_\_\_\_\_ 20. What is another name for a group of elements?
- a. a period
  - b. a family
  - c. an element
  - d. an electron
- \_\_\_\_\_ 21. Which of the following elements usually have similar properties?
- a. elements in a period
  - b. elements in a group
  - c. elements with the same color
  - d. elements in a horizontal row

**Directed Reading A *continued***

---

**Atomic Number**

- \_\_\_\_\_ **22.** How many of the recently discovered elements follow the periodic law?
- a.** half of them
  - b.** none of them
  - c.** every fifth element
  - d.** all of them
- \_\_\_\_\_ **23.** What does the periodic law say about the properties of elements?
- a.** They change periodically with the atomic numbers of the elements.
  - b.** They change periodically with the atomic mass of the elements.
  - c.** They change periodically with the mass number of the elements.
  - d.** They change periodically when the compound changes.
- \_\_\_\_\_ **24.** Where is the atomic number found for each element on the periodic table in your book?
- a.** to the left of the chemical symbol of each element
  - b.** to the right of the chemical symbol of each element
  - c.** below the chemical symbol of each element
  - d.** above the chemical symbol of each element
- \_\_\_\_\_ **25.** What are isotopes?
- a.** atoms that have the same number of protons but different numbers of electrons
  - b.** atoms that have the same number of protons but different numbers of neutrons
  - c.** atoms that have the same number of protons but different numbers of nuclei
  - d.** atoms that have the same number of electrons but different numbers of nuclei

## Skills Worksheet

**Directed Reading A****Section: Grouping the Elements** (pp. 202–209)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which of the following gives elements in a family or group similar properties?
- the same atomic mass
  - the same number of protons
  - the same number of electrons in their outer energy level
  - the same number of neutrons
- \_\_\_\_\_ 2. At the atomic level, what makes elements reactive?
- Their atoms have the same number of neutrons.
  - Their atoms have the same number of protons.
  - Their atoms have the same number of electrons.
  - Their atoms take, give, or share electrons with other atoms.

**GROUP 1: ALKALI METALS**

- \_\_\_\_\_ 3. In the periodic table of elements, what is the symbol for potassium?
- Li
  - K
  - Cs
  - Fr
- \_\_\_\_\_ 4. How are the alkali metals similar?
- They are very reactive.
  - They have very few uses.
  - They are so hard they cannot be cut.
  - They are often stored in water.
- \_\_\_\_\_ 5. How many outer-level electrons do alkali metal atoms have?
- four
  - three
  - two
  - one

**GROUP 2: ALKALINE-EARTH METALS**

- \_\_\_\_\_ 6. In the chart that illustrates Group 2 elements, which element is not an alkaline-earth metal?
- magnesium
  - calcium
  - barium
  - sodium

**Directed Reading A *continued***

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- \_\_\_\_\_ 7. Which of the following is true about all the alkaline-earth metals?
- a. They have low density.
  - b. They are less reactive than alkali metals are.
  - c. They have three outer-level electrons.
  - d. They have few uses.

**GROUPS 3–12: TRANSITION METALS**

- \_\_\_\_\_ 8. Which of the following is true about transition metals?
- a. They are less reactive than alkali and alkaline-earth metals.
  - b. They are more reactive than alkali and alkaline-earth metals.
  - c. They are equally as reactive as alkali and alkaline-earth metals.
  - d. They are not reactive.
- \_\_\_\_\_ 9. If groups are read from top to bottom, what elements are in Group 3?
- a. Sc, Ti, V, Mn
  - b. V, Nb, Ta, Db
  - c. Sc, Y, La, Ac
  - d. La, Hf, Ta, W
- \_\_\_\_\_ 10. What type of metal are the lanthanides and the actinides?
- a. transition metals
  - b. alkali metals
  - c. alkaline-earth metals
  - d. precious metals

**Properties of Transition Metals**

- \_\_\_\_\_ 11. Which of the following describes most transition metals?
- a. poor conductors of electric current
  - b. dull
  - c. good conductors of thermal energy
  - d. low density and melting points



**Directed Reading A *continued***

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- \_\_\_\_\_ **21.** Which element in Group 15 is found in nature only combined with other elements?
- a. nitrogen
  - b. oxygen
  - c. hydrogen
  - d. phosphorus

**GROUP 16: OXYGEN GROUP**

- \_\_\_\_\_ **22.** How much oxygen is in the air you breathe?
- a. 20%
  - b. 40%
  - c. 80%
  - d. none
- \_\_\_\_\_ **23.** What is necessary for substances to burn?
- a. fertilizer
  - b. oxygen
  - c. nitrogen
  - d. arsenic
- \_\_\_\_\_ **24.** What element of the oxygen group is a yellow solid in nature and is used to make sulfuric acid?
- a. nitrogen
  - b. oxygen
  - c. sulfur
  - d. phosphorus

**GROUP 17: HALOGENS**

- \_\_\_\_\_ **25.** Why are halogens so reactive?
- a. because their atoms only need two electrons to complete their outer level
  - b. because they are excellent conductors of electric current
  - c. because their atoms only need one electron to complete their outer level
  - d. because they have so few electrons in their outer level
- \_\_\_\_\_ **26.** What is made when a halogen reacts with a metal?
- a. a salt
  - b. a metalloid
  - c. a nonmetal
  - d. an electron



**Directed Reading A *continued***

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**GROUP 18: NOBLE GASES**

- \_\_\_\_\_ 27. Because scientists originally thought that these elements would not react at all, what were the noble gases first called?
- a. inept gases
  - b. inert gases
  - c. inverted gases
  - d. nongases
- \_\_\_\_\_ 28. How many nonmetals make up Group 18?
- a. five
  - b. six
  - c. three
  - d. two
- \_\_\_\_\_ 29. What element helps light bulbs last longer?
- a. neon
  - b. krypton
  - c. argon
  - d. xenon

**HYDROGEN**

- \_\_\_\_\_ 30. What is the symbol for hydrogen?
- a. Hy
  - b. K
  - c. H
  - d. Hi
- \_\_\_\_\_ 31. Which word or words describe hydrogen?
- a. colorless gas
  - b. unreactive
  - c. high density
  - d. not abundant

**The Uniqueness of Hydrogen**

- \_\_\_\_\_ 32. Where is hydrogen located on the periodic table?
- a. in Group 1
  - b. in Group 18
  - c. above Group 1
  - d. below Group 1

# Vocabulary and Section Summary A

## Arranging the Elements

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. periodic

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---

2. period

---

---

3. group

---

---

4. periodic law

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### SECTION SUMMARY

Read the following section summary.

- Mendeleev developed the first periodic table by listing the elements in order of increasing atomic mass. He used his table to predict that elements with certain properties would be discovered later.
- Properties of elements repeat in a regular, or periodic, pattern.
- Moseley rearranged the elements in order of increasing atomic number.
- Elements in the periodic table are classified as metals, nonmetals, and metalloids.
- Each element has a chemical symbol that identifies elements that make up compounds.
- A horizontal row of elements is called a period. Physical and chemical properties of elements change across each period.
- A vertical column of elements is called a group or family. Elements in a group usually have similar properties.
- The periodic law states that the repeating chemical and physical properties of elements relate to and depend on elements' atomic numbers.

# Vocabulary and Section Summary A

## Grouping the Elements

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. alkali metal

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2. alkaline-earth metal

---

---

3. halogen

---

---

4. noble gas

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### SECTION SUMMARY

Read the following section summary.

- Elements that are classified as alkali metals (Group 1) are the most reactive metals. Atoms of the alkali metals have one electron in their outer level.
- Elements that are classified as alkaline-earth metals (Group 2) are less reactive than the alkali metals are. Atoms of the alkaline-earth metals have two electrons in their outer level.
- Elements that are classified as transition metals (Groups 3–12) include most of the well-known metals and the lanthanides and actinides.
- Groups 13–16 contain the metalloids and some metals and nonmetals.
- Halogens (Group 17) are very reactive nonmetals. Atoms of the halogens have seven electrons in their outer level.
- Noble gases (Group 18) are unreactive nonmetals. Atoms of the noble gases have a full set of electrons in their outer level.
- Hydrogen is set off by itself in the periodic table. Its properties do not match the properties of any one group.

## Skills Worksheet

**Directed Reading A****Section: Electrons and Chemical Bonding** (pp. 226–229)**COMBINING ATOMS THROUGH CHEMICAL BONDING**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which of these substances is a combination of carbon, hydrogen, and oxygen?
- a. sugar
  - b. salt
  - c. water
  - d. sulfuric acid
- \_\_\_\_\_ 2. What is the joining of atoms to form new substances called?
- a. chemical bonding
  - b. physical bonding
  - c. chemical compounding
  - d. atomic joining
- \_\_\_\_\_ 3. What do you call an interaction that holds two atoms together?
- a. a chemical hold
  - b. a chemical bond
  - c. a chemical connection
  - d. an atomic bond
- \_\_\_\_\_ 4. What can be shared in chemical bonds?
- a. atoms
  - b. protons
  - c. electrons
  - d. neutrons

**Discussing Bonding Using Models**

- \_\_\_\_\_ 5. What do we use to help us know why atoms form bonds?
- a. observations
  - b. maps
  - c. charts
  - d. models

**ELECTRON NUMBER AND ORGANIZATION**

- \_\_\_\_\_ 6. How many valence electrons are in an oxygen atom?
- a. 2
  - b. 4
  - c. 6
  - d. 8

**Directed Reading A *continued***

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**Use the terms from the following list to complete the sentences below.**

valence electron  
group

atomic number  
energy levels

7. The number of protons in an atom is its \_\_\_\_\_.
8. Electrons in an atom are organized in \_\_\_\_\_.
9. On the periodic table, atoms in the same \_\_\_\_\_ have the same number of valence electrons.
10. An electron in the outermost energy level of an atom is a(n) \_\_\_\_\_.

**TO BOND OR NOT TO BOND**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 11. What determines whether an atom will form bonds?
- a. the number of electrons
  - b. the number of valence electrons
  - c. the number of protons
  - d. the number of neutrons
- \_\_\_\_\_ 12. Which group on the periodic table contains elements that do not normally form bonds?
- a. Group 2
  - b. Group 6
  - c. Group 10
  - d. Group 18

**Use the terms from the following list to complete the sentences below.**

eight  
electrons

two  
helium

13. Atoms bond by gaining, losing, or sharing \_\_\_\_\_.
14. A filled outermost level in most atoms has \_\_\_\_\_ electrons.
15. The first energy level of an atom can hold only \_\_\_\_\_ electrons.
16. The outermost energy level in a(n) \_\_\_\_\_ atom is also the first energy level.

## Skills Worksheet

**Directed Reading A****Section: Ionic Bonds** (pp. 230–235)**FORMING IONIC BONDS**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What do you call a bond that forms when electrons are transferred from one atom to another?
- a compound bond
  - an ionic bond
  - a crystal bond
  - an atomic bond

**Charged Particles**

- \_\_\_\_\_ 2. What are charged particles that form when atoms gain or lose electrons?
- ions
  - neutrons
  - bonds
  - particle atoms
- \_\_\_\_\_ 3. Why are ions charged particles?
- The number of electrons does not equal the number of protons.
  - The number of protons does not equal the number of neutrons.
  - The number of neutrons does not equal the number of electrons.
  - The electric charges of the electrons and protons cancel each other.

**FORMING POSITIVE IONS**

- \_\_\_\_\_ 4. An aluminum atom can lose 3 electrons in order to have a full outer energy level. What charge does the resulting aluminum ion have?
- $1^+$
  - $3^+$
  - $2^+$
  - $2^+$
- \_\_\_\_\_ 5. What is the chemical symbol for an aluminum ion?
- $\text{Al}^{3+}$
  - $\text{Al}^{3-}$
  - $\text{Al}^{2+}$
  - $\text{Al}^{2-}$

**Directed Reading A *continued***

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Use the terms from the following list to complete the sentences below.

positive ions                      valence electrons                      ion  
energy                                  negative ions

6. If an aluminum atom loses its three valence electrons, it becomes a(n) \_\_\_\_\_.
7. For electrons to pull away from atoms, \_\_\_\_\_ is needed.
8. When atoms lose electrons in an ionic bond, they form \_\_\_\_\_.
9. Most metals have few \_\_\_\_\_ and form positive ions.
10. The energy needed to take electrons from metals comes from the formation of \_\_\_\_\_.

**FORMING NEGATIVE IONS**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 11. When atoms gain electrons during chemical changes, what charge do they have?
- a. positive charge
  - b. negative charge
  - c. neutral charge
  - d. electric charge

**How Nonmetal Atoms Become Negative Ions**

- \_\_\_\_\_ 12. The symbol for the oxide ion is  $O^{2-}$ . How many electrons must an oxygen atom gain to become an oxide ion?
- a. 0
  - b. 1
  - c. 2
  - d. 3
- \_\_\_\_\_ 13. What ending is used for the names of negative ions?
- a. *-ion*
  - b. *-ade*
  - c. *-ide*
  - d. *-ite*

**Directed Reading A** *continued*

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**The Energy of Gaining Electrons**

- \_\_\_\_\_ **14.** What do atoms of Group 17 elements give off when they gain electrons?
- a.** energy
  - b.** protons
  - c.** bonds
  - d.** charges

**FORMING IONIC COMPOUNDS**

- \_\_\_\_\_ **15.** How do the properties of sodium and chlorine compare to the properties of the ionic compound sodium chloride?
- a.** They are the same.
  - b.** They are charged.
  - c.** They have a crystal lattice structure.
  - d.** They are different.
- \_\_\_\_\_ **16.** What is the repeating three-dimensional pattern that forms when ions bond?
- a.** a compound
  - b.** a chemical compound
  - c.** a crystal lattice
  - d.** an ionic bond

**IONIC COMPOUNDS**

**Properties of Ionic Compounds**

- \_\_\_\_\_ **17.** Which of the following is a property of many ionic compounds?
- a.** low melting point
  - b.** high melting point
  - c.** low boiling point
  - d.** malleability



## Skills Worksheet

**Directed Reading A****Section: Covalent and Metallic Bonds** (pp. 236–241)**COVALENT BONDS**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Sugar and water are each held together by which type of bond?  
a. metallic  
b. covalent  
c. ionic  
d. atomic
- \_\_\_\_\_ 2. Which is a typical property of a substance formed with covalent bonds?  
a. low melting point  
b. high density  
c. malleability  
d. high boiling point
- \_\_\_\_\_ 3. What forms when atoms share one or more pairs of electrons?  
a. a valence electron  
b. an ionic bond  
c. an element  
d. a covalent bond

**Covalent Bonds and Molecules**

Match the correct description with the correct term. Write the letter in the space provided.

- \_\_\_\_\_ 4. consists of two or more atoms joined together in a definite ratio      a. molecule  
b. electron-dot diagram
- \_\_\_\_\_ 5. used to show the valence electrons in an atom

**COVALENT COMPOUNDS AND MOLECULES**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 6. What is the smallest unit of a covalently bonded compound that keeps all the properties of the compound?  
a. a molecule  
b. an electron  
c. a covalent bond  
d. an ion

**Directed Reading A *continued***

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**The Simplest Molecules**

- \_\_\_\_\_ 7. What is a molecule made up of two atoms called?
- a diatomic element
  - a diatomic molecule
  - a molecular element
  - a covalent molecule
- \_\_\_\_\_ 8. What is an element found in nature as diatomic molecules called?
- a diatomic element
  - a diatomic molecule
  - a molecular element
  - a covalent molecule
- \_\_\_\_\_ 9. Oxygen and nitrogen are examples of which of the following?
- diatomic elements
  - monatomic molecules
  - molecular elements
  - ionic molecules
- \_\_\_\_\_ 10. How are shared electrons in molecules of diatomic elements counted?
- as valence electrons for each atom
  - as valence molecules for each item
  - as extra electrons
  - They aren't counted.

**More-Complex Molecules**

Use the terms from the following list to complete the sentences below.

diatomic  
carbon

complex  
four

11. The simplest molecules are \_\_\_\_\_ molecules.
12. Soap and proteins are examples of \_\_\_\_\_ molecules.
13. The basis of many complex molecules is the \_\_\_\_\_ atom.
14. Carbon atoms need to make \_\_\_\_\_ covalent bonds to have eight valence electrons.

**Directed Reading A *continued***

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**METALLIC BONDS**

Use the terms from the following list to complete the sentences below.

electrons

metallic bond

15. A bond that forms when charged metal ions attract electrons in a metal

is a(n) \_\_\_\_\_.

16. Positively charged metal ions form when metal atoms lose

\_\_\_\_\_.

**Movement of Electrons Throughout a Metal**

Write the letter of the correct answer in the space provided.

\_\_\_\_\_ 17. Why does bonding occur in metals?

- a. because the atoms are far apart
- b. because the atoms are shiny
- c. because the outer energy levels of the atoms overlap
- d. because the outer energy levels of the atoms are far apart

**PROPERTIES OF METALS**

\_\_\_\_\_ 18. Which one of the following properties is NOT due to metallic bonds?

- a. electrical conductivity
- b. ductility
- c. solubility
- d. malleability

Match the correct definition with the correct term. Write the letter in the space provided.

\_\_\_\_\_ 19. the ability of metal to be drawn into wires

\_\_\_\_\_ 20. the ability of metal to be hammered into sheets

\_\_\_\_\_ 21. allow metals to be bent, but not broken

\_\_\_\_\_ 22. the ability to conduct electric current

a. moving electrons

b. malleability

c. ductility

d. conductivity

# Vocabulary and Section Summary A

## Electrons and Chemical Bonding

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. chemical bonding

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2. chemical bond

---

---

---

3. valence electron

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---

### SECTION SUMMARY

Read the following section summary.

- Chemical bonds form when atoms join to form new substances. A chemical bond is an interaction that holds two atoms together.
- A valence electron is an electron in the outermost energy level of an atom.
- Most atoms form bonds by gaining, losing, or sharing electrons until they have eight valence electrons. Atoms of some elements need only two electrons to fill their outermost level.

# Vocabulary and Section Summary A

## Ionic Bonds

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. ionic bond

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---

2. ion

---

---

---

3. crystal lattice

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---

### SECTION SUMMARY

Read the following section summary.

- An ionic bond forms when electrons are transferred from one atom to another. During ionic bonding, the atoms become oppositely charged ions.
- Ionic bonding usually occurs between atoms of metals and atoms of nonmetals.
- Energy is needed to remove electrons from metal atoms. Energy is released when most nonmetal atoms gain electrons.
- Ionic compounds form solids by building up a three-dimensional repeating pattern called a crystal lattice.
- Ionic compounds are brittle and highly soluble, with high melting and boiling points.

# Vocabulary and Section Summary A

## Covalent and Metallic Bonds

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. covalent bond

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---

---

2. molecule

---

---

---

3. metallic bond

---

---

---

### SECTION SUMMARY

Read the following section summary.

- In covalent bonding, two atoms share electrons. A covalent bond forms when atoms share one or more pairs of electrons.
- Covalently bonded atoms form a particle called a *molecule*. A molecule is the smallest particle of a compound that has the chemical properties of the compound.
- In metallic bonding, the valence electrons move throughout the metal. A metallic bond is formed by the attraction between positive metal ions and the electrons in the metal.
- Properties of metals include electrical conductivity, ductility, and malleability.

## Directed Reading A

### Section: Forming New Substances (pp. 256–261)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which of the following causes leaves to change color?
- a. energy
  - b. precipitate
  - c. chlorophyll
  - d. gas

### CHEMICAL REACTIONS

- \_\_\_\_\_ 2. Which of the following occurs when chlorophyll breaks down into new substances?
- a. solid formation
  - b. a chemical reaction
  - c. a physical reaction
  - d. gas formation
- \_\_\_\_\_ 3. Which of the following is true of the new materials formed in a chemical reaction?
- a. Their physical and chemical properties differ from those of the original materials.
  - b. Their properties are the same as those of the original materials.
  - c. Only their physical properties differ from those of the original materials.
  - d. Only their chemical properties differ from those of the original materials.

### Signs of Chemical Reactions

- \_\_\_\_\_ 4. Which of the following is a sign of a chemical reaction?
- a. thermal energy from a fire
  - b. ice melting on the ground
  - c. steam from a teapot
  - d. water freezing on a pond

## Directed Reading A *continued*

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Use the terms from the following list to complete the sentences below.

precipitate

chemical reaction

5. When a substance changes to make a new substance,

a(n) \_\_\_\_\_ occurs.

6. A solid that is formed in a solution is called a(n) \_\_\_\_\_.

### A Change of Properties

Write the letter of the correct answer in the space provided.

\_\_\_\_\_ 7. How can you be sure a chemical reaction is happening?

a. A solid dissolves.

b. A new substance with different properties forms.

c. Water turns to steam.

d. A mixture is made.

### BONDS: HOLDING MOLECULES TOGETHER

Use the terms from the following list to complete the sentences below.

diatomic

substances

chemical bond

molecules

8. The force that holds two atoms together is called

a(n) \_\_\_\_\_.

9. When \_\_\_\_\_ bump into one another with enough energy, chemical bonds can break.

10. When chemical bonds break, the atoms rearrange to form new

\_\_\_\_\_.

11. A molecule made up of two atoms is \_\_\_\_\_.

### REACTIONS AND ENERGY

#### Exothermic Reactions

Write the letter of the correct answer in the space provided.

\_\_\_\_\_ 12. What happens in an exothermic reaction?

a. Heat is released.

b. Heat is taken in.

c. Heat changes to gas.

d. Heat changes to light.



**Directed Reading A *continued***

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**Endothermic Reactions**

\_\_\_\_\_ **13.** What happens in an endothermic reaction?

- a. Heat is released.
- b. Heat is taken in.
- c. Water is released.
- d. Water is taken in.

\_\_\_\_\_ **14.** Which of the following is an example of an endothermic process?

- a. a fire
- b. steam
- c. a light stick
- d. photosynthesis

**The Law of Conservation of Energy**

\_\_\_\_\_ **15.** According to the law of conservation of energy, which of the following is NOT true?

- a. Energy can be transferred.
- b. Energy cannot be created or destroyed.
- c. Energy cannot change forms.
- d. Energy can change forms.

# Directed Reading A

## Section: Chemical Formulas and Equations (pp. 262–267)

### CHEMICAL FORMULAS

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. About how many elements form all substances?
- 10
  - 100
  - 200
  - 1,000
- \_\_\_\_\_ 2. A combination of chemical symbols and numbers that represents a substance is called what?
- a chemical formula
  - a chemical bond
  - a chemical sentence
  - a chemical reaction
- \_\_\_\_\_ 3. What does a chemical formula show about each element?
- the number of atoms
  - the number of chemicals
  - the number of electrons
  - the number of metals
- \_\_\_\_\_ 4. What is the number 2 called in the formula  $H_2O$ ?
- a superscript
  - an element
  - a symbol
  - a subscript

### Writing Formulas for Covalent Compounds

- \_\_\_\_\_ 5. Which of the following is the chemical formula for carbon dioxide?
- $C_2O$
  - $CO_2$
  - $2CO$
  - $CO$
- \_\_\_\_\_ 6. What does a prefix in a chemical's name represent?
- the number of atoms of one element
  - the number of chemicals
  - the number of molecules
  - the number of elements

**Directed Reading A *continued***

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**Writing Formulas for Ionic Compounds**

- \_\_\_\_\_ 7. What makes up an ionic compound?
- two chemicals
  - two nonmetals
  - a metal and a nonmetal
  - two charged metals
- \_\_\_\_\_ 8. What is the overall charge in an ionic compound?
- 2
  - 1
  - 0
  - 1

**CHEMICAL EQUATIONS****Describing Reactions by Using Equations**

Use the terms from the following list to complete the sentences below.

product                      reactant                      chemical equation

9. Using chemical symbols and numbers to describe a chemical reaction is known as a(n) \_\_\_\_\_.
10. A substance or molecule that participates in a chemical reaction is called a(n) \_\_\_\_\_.
11. The substance that forms in a chemical reaction is called a(n) \_\_\_\_\_.

**The Importance of Accuracy**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 12. Which of the following is true of the chemical symbols CO<sub>2</sub>, CO, and Co?
- No one will ever confuse them.
  - Confusing them will not make a difference.
  - They represent the same chemical formula.
  - They represent different chemical formulas and elements.

**Why Equations Must Be Balanced**

- \_\_\_\_\_ 13. Which of the following happens to atoms in a chemical reaction?
- They are sometimes lost, never rearranged.
  - They are sometimes lost, gained, or rearranged.
  - They are never lost or gained, just rearranged.
  - They are lost or gained, never rearranged.

**Directed Reading A *continued***

---

- \_\_\_\_\_ **14.** When you write a chemical equation, the number of atoms of each element in the reactants must be what?
- a.** equal to the number in the products
  - b.** less than one
  - c.** greater than one
  - d.** zero
- \_\_\_\_\_ **15.** Which law states that mass is neither created nor destroyed in ordinary chemical and physical changes?
- a.** law of conservation of energy
  - b.** law of chemical reactions
  - c.** law of conservation of mass
  - d.** law of balanced equations

**How to Balance an Equation**

- \_\_\_\_\_ **16.** Which of the following is the coefficient in the formula  $2\text{H}_2\text{O}$ ?
- a.** 0
  - b.** 2
  - c.**  $\text{H}_2\text{O}$
  - d.**  $\text{H}_2$
- \_\_\_\_\_ **17.** What must be done for a chemical equation to be balanced?
- a.** All molecules must be counted.
  - b.** All chemicals must be equal.
  - c.** All atoms must be counted.
  - d.** All atoms must be discounted.
- \_\_\_\_\_ **18.** When you balance an equation, which of the following are changed?
- a.** metals
  - b.** subscripts
  - c.** coefficients
  - d.** formulas

# Vocabulary and Section Summary A

## Forming New Substances

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. chemical reaction

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2. precipitate

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3. exothermic reaction

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4. endothermic reaction

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5. law of conservation of energy

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### SECTION SUMMARY

Read the following section summary.

- A chemical reaction is a process by which substances change to form new substances with new chemical and physical properties.
- Signs that indicate a chemical reaction has taken place are a color change, formation of a gas or a solid, and the release or absorption of energy.
- During a reaction, bonds are broken, atoms are rearranged, and new bonds are formed.
- Exothermic reactions give off energy, and endothermic reactions absorb energy.
- The law of conservation of energy states that energy is neither created nor destroyed.

# Vocabulary and Section Summary A

## Chemical Formulas and Equations

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. chemical formula

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2. chemical equation

---

---

3. reactant

---

---

4. product

---

---

5. law of conservation of mass

---

---

### SECTION SUMMARY

Read the following section summary.

- A chemical formula uses symbols and subscripts to describe the makeup of a compound.
- Chemical formulas can often be written from the names of covalent and ionic compounds.
- A chemical equation uses chemical formulas, chemical symbols, and coefficients to describe a reaction.
- A balanced equation has the same numbers and kinds of atoms on each side of the equation.
- A balanced equation shows the law of conservation of mass: mass is neither created nor destroyed during ordinary physical and chemical changes.

## Skills Worksheet

**Directed Reading A****Section: Ionic and Covalent Compounds** (pp. 282–285)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What is the interaction that holds atoms and ions together called?
- an electron bond
  - a chemical bond
  - an ionic bond
  - a valence bond
- \_\_\_\_\_ 2. What kind of electron determines if a compound is covalent or ionic?
- ionic
  - covalent
  - compound
  - valence

**IONIC COMPOUNDS AND THEIR PROPERTIES**

Use the terms from the following list to complete the sentences below.

ions

sodium chloride

metals

ionic compounds

3. An ionic bond is an attraction between oppositely charged \_\_\_\_\_.
4. Compounds that have ionic bonds are called \_\_\_\_\_.
5. Ionic compounds can be formed when \_\_\_\_\_ react with nonmetals.
6. Another name for table salt is \_\_\_\_\_.

**Brittleness**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 7. What do ionic compounds usually do when they are hit?
- roll over
  - break apart
  - form a lattice
  - bond together

**Directed Reading A *continued***

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- \_\_\_\_\_ 8. What kind of structure does an ionic compound have?
- a. ionic
  - b. opposite
  - c. brittle
  - d. crystal lattice

**High Melting Points**

Use the terms from the following list to complete the sentences below.

solids

ionic compounds

9. Strong bonds make \_\_\_\_\_ have high melting points.
10. High melting points are the reason that most ionic compounds are \_\_\_\_\_ at room temperature.

**Solubility and Electrical Conductivity**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 11. What do many ionic compounds dissolve easily in?
- a. air
  - b. water
  - c. oil
  - d. current
- \_\_\_\_\_ 12. What do water molecules do to ions?
- a. push them together
  - b. conduct them
  - c. pull them apart
  - d. heat them
- \_\_\_\_\_ 13. What can an ionic compound conduct after it dissolves in water?
- a. ions
  - b. electric current
  - c. crystals
  - d. heat

**COVALENT COMPOUNDS AND THEIR PROPERTIES**

- \_\_\_\_\_ 14. What kind of compound is formed by the sharing of electrons?
- a. an ionic compound
  - b. a crystal compound
  - c. a covalent compound
  - d. an electron compound



**Directed Reading A *continued***

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- \_\_\_\_\_ 15. What is the group of atoms that make up a single unit of a covalent compound called?
- a. an ionic bond
  - b. a salt
  - c. a molecule
  - d. a crystal lattice

**Solubility**

- \_\_\_\_\_ 16. What do many covalent compounds NOT dissolve well in?
- a. air
  - b. water
  - c. gas
  - d. oil

**Low Melting Points**

- \_\_\_\_\_ 17. How do the attractive forces of covalent compounds differ from those of ionic compounds?
- a. The attractive forces are hotter.
  - b. The attractive forces are weaker.
  - c. The attractive forces are colder.
  - d. The attractive forces are larger.
- \_\_\_\_\_ 18. Why do covalent compounds have lower melting points than ionic compounds?
- a. Less heat is needed to separate their molecules.
  - b. More heat is needed to separate their molecules.
  - c. Their molecules cannot separate.
  - d. Their molecules are always separated.

**Electrical Conductivity**

- \_\_\_\_\_ 19. Which of the following is a covalent compound that dissolves in water?
- a. oil
  - b. salt
  - c. sugar
  - d. nickel oxide
- \_\_\_\_\_ 20. What kind of compound is sugar?
- a. attractive
  - b. covalent
  - c. ionic
  - d. metal
- \_\_\_\_\_ 21. Why can't a solution of sugar and water conduct an electric current?
- a. Sugar forms too many ions.
  - b. Sugar is not a covalent compound.
  - c. Sugar doesn't form ions.
  - d. Sugar dissolves in water.

## Skills Worksheet

**Directed Reading A****Section: Acids and Bases** (pp. 286–291)**ACIDS AND THEIR PROPERTIES**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What is a compound that increases hydronium ions in solution called?
- oxygen
  - an acid
  - an indicator
  - carbon
- \_\_\_\_\_ 2. What kind of ions separate from acids in solution?
- oxygen
  - carbon
  - water
  - hydrogen
- \_\_\_\_\_ 3. What do hydrogen ions bond with to form hydronium ions?
- oxygen ions
  - carbon ions
  - water molecules
  - other hydrogen ions

**Acids Have a Sour Flavor**

Use the terms from the following list to complete the sentences below.

corrosive

acids

citric

4. Foods that taste sour usually contain \_\_\_\_\_.
5. The taste of citrus fruits comes from \_\_\_\_\_ acid.
6. Many acids are \_\_\_\_\_, which means that they can destroy things.

**Acids Change Colors of Indicators**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 7. What is a compound that can change color depending on conditions such as pH?
- water
  - hydrogen
  - paper
  - an indicator

**Directed Reading A *continued***

---

- \_\_\_\_\_ 8. What happens when acid is added to blue litmus paper?
- a. The paper turns red.
  - b. The paper turns green.
  - c. The paper stays blue.
  - d. The paper turns orange.
- \_\_\_\_\_ 9. Which of the following is NOT an indicator?
- a. blue litmus paper
  - b. red litmus paper
  - c. bromthymol blue
  - d. hydrochloric acid

**Acids React With Metals**

- \_\_\_\_\_ 10. What do acids that react with some metals produce?
- a. oxygen gas
  - b. hydrogen gas
  - c. natural gas
  - d. helium gas

**Acids Conduct Electric Current**

- \_\_\_\_\_ 11. Because acids form ions, what can they conduct?
- a. water molecules
  - b. acid solutions
  - c. electric current
  - d. hydronium

**Uses of Acids**

**Match the correct description with the correct term. Write the letter in the space provided.**

- |                                  |                      |
|----------------------------------|----------------------|
| _____ 12. used to make paper     | a. hydrochloric acid |
| _____ 13. used to make plastics  | b. nitric acid       |
| _____ 14. used in soft drinks    | c. sulfuric acid     |
| _____ 15. used in swimming pools | d. carbonic acid     |

**Directed Reading A *continued***

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**BASES AND THEIR PROPERTIES**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 16. What is a compound that adds hydroxide ions when dissolved in water called?
- a. an acid
  - b. a base
  - c. sodium
  - d. neutral
- \_\_\_\_\_ 17. Which ions give bases their properties?
- a. sodium ions
  - b. hydrogen ions
  - c. hydroxide ions
  - d. chloride ions

**Bases Have a Bitter Flavor and a Slippery Feel**

- \_\_\_\_\_ 18. What gives soap a bitter taste and slippery feel?
- a. a base
  - b. an acid
  - c. dirt
  - d. water
- \_\_\_\_\_ 19. Why should you NEVER taste or touch an unknown base?
- a. Many are slimy.
  - b. Many are too watery.
  - c. Many turn colors.
  - d. Many are corrosive.

**Bases Change Color of Indicators**

- \_\_\_\_\_ 20. Bases change the color of red litmus paper to what color?
- a. green
  - b. blue
  - c. orange
  - d. pink

**Bases Conduct Electric Current**

- \_\_\_\_\_ 21. Because bases increase hydroxide ions in solution, what can they conduct?
- a. water molecules
  - b. negativity
  - c. hydrogen
  - d. electric current

**Directed Reading A** *continued*

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**Uses of Bases**

**Match the correct description with the correct term. Write the letter in the space provided.**

\_\_\_\_\_ **22.** used in soap

\_\_\_\_\_ **23.** used in cement

\_\_\_\_\_ **24.** used in antacids

\_\_\_\_\_ **25.** used in household cleaners

**a.** ammonia

**b.** calcium hydroxide

**c.** magnesium hydroxide

**d.** sodium hydroxide

# Directed Reading A

## Section: Solutions of Acids and Bases (pp. 292–295)

### STRENGTHS OF ACIDS AND BASES

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What does the strength of an acid or base depend on?
- a. molecules that bond together
  - b. concentration
  - c. the number of molecules that break apart
  - d. the amount of the acids or base

#### Strong Versus Weak Acids

- \_\_\_\_\_ 2. When a strong acid dissolves in water, how many molecules break apart?
- a. only a few
  - b. about one fourth
  - c. about half
  - d. all
- \_\_\_\_\_ 3. When a weak acid dissolves in water, how many molecules break apart?
- a. only a few
  - b. about one fourth
  - c. about half
  - d. all

#### Strong Versus Weak Bases

- \_\_\_\_\_ 4. What would you call a base if all of its molecules break apart in water?
- a. a weak base
  - b. a neutral base
  - c. a strong base
  - d. a medium base

**Directed Reading A *continued***

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**ACIDS, BASES, AND NEUTRALIZATION**

Use the terms from the following list to complete the sentences below.

salt    neutralization                          water

5. When acids and bases combine to form a neutral solution, it is called a(n) \_\_\_\_\_ reaction.
6.  $H^+$  ions in an acid and  $OH^-$  ions in a base combine to form \_\_\_\_\_.
7. If the water in an acid-base solution evaporates, the ions form a(n) \_\_\_\_\_.

**The pH Scale**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 8. What is the value used to express acidity or basicity called?  
a. solution  
b. indicator  
c. pH  
d. concentration
- \_\_\_\_\_ 9. What identifies whether a solution has an acid or a base?  
a. water  
b. indicator  
c. electric current  
d. concentration
- \_\_\_\_\_ 10. What is the pH of a neutral solution such as pure water?  
a. 7  
b. 4  
c. 1  
d. 9
- \_\_\_\_\_ 11. What is the pH of a basic solution?  
a. less than 7  
b. greater than 7  
c. 7  
d. neutral
- \_\_\_\_\_ 12. What is the pH of an acidic solution?  
a. greater than 7  
b. less than 7  
c. 7  
d. neutral

**Directed Reading A *continued***

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**Match the correct description with the correct term. Write the letter in the space provided.**

- |                            |                       |
|----------------------------|-----------------------|
| _____ 13. basic solution   | <b>a.</b> lemon juice |
| _____ 14. acidic solution  | <b>b.</b> detergent   |
| _____ 15. neutral solution | <b>c.</b> pure water  |

**Using Indicators to Determine pH**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 16. What can a group of indicators be used to find?
- a.** electric current
  - b.** pH
  - c.** solution
  - d.** concentration
- \_\_\_\_\_ 17. What electronic device can be used to find the pH of a solution?
- a.** litmus paper
  - b.** pH paper
  - c.** bromthymol blue
  - d.** a pH meter

**pH and the Environment**

- \_\_\_\_\_ 18. What do living things need in their environment?
- a.** polluted air
  - b.** a certain pH
  - c.** colors
  - d.** indicators
- \_\_\_\_\_ 19. What can die if acid rain lowers the pH of lakes?
- a.** indicators
  - b.** robins
  - c.** fish
  - d.** rocks

**SALTS**

- \_\_\_\_\_ 20. What is formed when an acid neutralizes a base?
- a.** water and a salt
  - b.** snow and ice
  - c.** an indicator
  - d.** a high pH



**Directed Reading A** *continued*

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**Uses of Salts**

**Match the correct description with the correct term Write the letter in the space provided.**

\_\_\_\_\_ **21.** used to preserve food

\_\_\_\_\_ **22.** used to make wallboard

\_\_\_\_\_ **23.** used to season food

**a.** sodium chloride

**b.** calcium sulfate

**c.** sodium nitrate

# Vocabulary and Section Summary A

## Ionic and Covalent Compounds

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. chemical bond

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2. ionic compound

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---

3. covalent compound

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### SECTION SUMMARY

Read the following section summary.

- Ionic compounds have ionic bonds between ions of opposite charges.
- Ionic compounds are usually brittle, have high melting points, dissolve in water, and often conduct an electric current in solution.
- Covalent compounds have covalent bonds and consist of particles called *molecules*.
- Many covalent compounds have low melting points, do not dissolve in water, and do not conduct an electric current in solution.

# Vocabulary and Section Summary A

## Acids and Bases

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. acid

---

---

---

2. indicator

---

---

---

3. base

---

---

---

### SECTION SUMMARY

Read the following section summary.

- An acid is a compound that increases the number of hydronium ions in solution.
- Acids taste sour, turn blue litmus paper red, react with metals to produce hydrogen gas, and may conduct an electric current when in solution.
- Acids are used for industrial purposes and in household products.
- A base is a compound that increases the number of hydroxide ions in solution.
- Bases taste bitter, feel slippery, and turn red litmus paper blue. Most solutions of bases conduct an electric current.
- Bases are used in cleaning products and antacids.

# Vocabulary and Section Summary A

## Solutions of Acids and Bases

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. neutralization reaction

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---

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2. pH

---

---

---

3. salt

---

---

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### SECTION SUMMARY

Read the following section summary.

- Every molecule of a strong acid or base breaks apart to form ions. Few molecules of weak acids and bases break apart to form ions.
- An acid and a base can neutralize one another to make salt and water.
- pH is a measure of hydronium ion concentration in a solution.
- A salt is an ionic compound formed when an acid reacts with a base.



**Directed Reading A *continued***

---

Use the terms from the following list to complete the sentences below.

single bond

triple bond

double bond

petroleum

8. A(n) \_\_\_\_\_ is formed when carbon atoms form two covalent bonds between them.
9. Gasoline is made from \_\_\_\_\_.
10. When carbon atoms form four separate covalent bonds, each bond is called a(n) \_\_\_\_\_.
11. A grouping of three bonds between two carbon atoms is called a(n) \_\_\_\_\_.

**OTHER ELEMENTS IN LIVING ORGANISMS**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 12. On what do all living things depend?
- a. physical compounds
  - b. organic compounds
  - c. nuclear compounds
  - d. atomic compounds

**Elements in Organic Compounds**

- \_\_\_\_\_ 13. What six elements make up most of the molecules in your body?
- a. carbon, helium, oxygen, nitrogen, sulfur, and phosphorus
  - b. carbon, hydrogen, oxygen, nitrogen, sulfur, and phosphorus
  - c. carbon, hydrogen, oxygen, nitrogen, sulfur, and potassium
  - d. calcium, hydrogen, oxygen, nitrogen, and phosphorus

**Organic Compounds—Not Just from Living Things!**

- \_\_\_\_\_ 14. On what element are all organic compounds based?
- a. helium
  - b. nitrogen
  - c. sulfur
  - d. carbon
- \_\_\_\_\_ 15. Which of the following is NOT true about organic compounds?
- a. They are all based on carbon.
  - b. They make up living organisms.
  - c. They can only be made by living organisms.
  - d. They can be manufactured.

## Skills Worksheet

**Directed Reading A****Section: Compounds of Living Things** (pp. 314–319)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What are large organic compounds that living things make and use called?
- a. biochemicals
  - b. atoms
  - c. polymers
  - d. chains

**CARBOHYDRATES**

Use the terms from the following list to complete the sentences below.

simple

carbohydrates

complex

polymer

2. A class of nutrients that includes sugar, starches, and fiber is called \_\_\_\_\_.
3. A chain of repeating units is called a(n) \_\_\_\_\_.
4. Sugars like glucose are \_\_\_\_\_ carbohydrates.
5. Thousands of sugar molecules can make \_\_\_\_\_ carbohydrates.

**LIPIDS**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 6. What type of biochemical does NOT dissolve in water?
- a. protein
  - b. lipid
  - c. carbohydrate
  - d. vitamin
- \_\_\_\_\_ 7. What do lipids store?
- a. energy
  - b. starch
  - c. plants
  - d. vitamins

**Directed Reading A *continued***

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- \_\_\_\_\_ **8.** Which of the following is NOT true of lipids?
- a.** They are mostly made of carbon and hydrogen.
  - b.** They are very large molecules.
  - c.** They are used to store some vitamins.
  - d.** They have very short chains of carbon atoms.

**PROTEINS**

**Use the terms from the following list to complete the sentences below.**

hemoglobin                      amino acids                      proteins

- 9.** Biochemicals made up of amino acids are called \_\_\_\_\_.
- 10.** A protein called \_\_\_\_\_ is found in red blood cells.
- 11.** The building blocks of proteins are called \_\_\_\_\_.

**NUCLEIC ACIDS**

**Use the terms from the following list to complete the sentences below.**

nucleotides                      proteins                      nucleic acids

- 12.** Nucleic acids carry information that cells need to make \_\_\_\_\_.
- 13.** The largest molecules made by living things are \_\_\_\_\_.
- 14.** Subunits that make up nucleic acids are called \_\_\_\_\_.

**DNA AND RNA**

**Match the correct description with the correct term. Write the letter in the space provided.**

- |  |                       |
|--|-----------------------|
| _____ <b>15.</b> make up the rungs of the DNA ladder | <b>a.</b> DNA         |
| _____ <b>16.</b> helps build proteins                | <b>b.</b> RNA         |
| _____ <b>17.</b> a cell's genetic material           | <b>c.</b> nucleotides |



**Directed Reading A *continued***

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**OTHER IMPORTANT COMPOUNDS**

**Water**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ **18.** What makes up 70% of your body?
- a.** carbohydrates
  - b.** fat
  - c.** water
  - d.** protein
- \_\_\_\_\_ **19.** Which of the following is NOT one of water's functions?
- a.** regulating temperature
  - b.** helping to transport substances
  - c.** providing lubrication
  - d.** storing genetic information

**Salt**

- \_\_\_\_\_ **20.** What role does salt play in your body?
- a.** It helps nerve cells.
  - b.** It helps vision.
  - c.** It helps energy.
  - d.** It helps lubrication.

# Vocabulary and Section Summary A

## Elements in Living Things

### VOCABULARY

In your own words, write a definition of the following term in the space provided.

1. organic compound

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### SECTION SUMMARY

Read the following section summary.

- Organic compounds are compounds that contain the element carbon.
- Organic compounds play a central role in the chemistry of living organisms because of carbon's ability to bond with other elements and to form long chains with other carbon atoms.
- Living organisms are made of compounds that are composed mostly of the elements carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur.

# Vocabulary and Section Summary A

## Compounds of Living Things

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. carbohydrate

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2. lipid

---

---

---

3. protein

---

---

---

4. nucleic acid

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### SECTION SUMMARY

Read the following section summary.

- Carbohydrates provide energy for living organisms. Many complex carbohydrates are made of long chains of simple sugars.
- Lipids have long carbon chains, store energy, and make up cell membranes.
- Proteins are composed of amino acids and perform special functions within cells.
- Nucleic acids store the genetic information that cells use to make proteins.
- In addition to large biochemical compounds, much smaller compounds, such as water and salt, are also important to organisms.

# Directed Reading A

## Section: Measuring Motion (pp. 336–343)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which of the following is occurring all around us, even if we don't see anything moving?
- a. average speed
  - b. motion
  - c. constant velocity
  - d. constant acceleration

### MOTION AND REFERENCE POINTS

- \_\_\_\_\_ 2. What is a reference point?
- a. an object that appears to stay in place
  - b. an object that appears to keep moving
  - c. an object that stays at the same velocity
  - d. an object that stays at the same acceleration
- \_\_\_\_\_ 3. What is an object's change in position over time relative to a reference point called?
- a. speed
  - b. acceleration
  - c. friction
  - d. motion

### Standard Reference Points

- \_\_\_\_\_ 4. A nonmoving object on Earth's surface can be used as which of the following for seeing motion?
- a. a standard reference point
  - b. a standard starting point
  - c. a standard finishing point
  - d. a standard midpoint

### Motion in a Two-Dimensional System

- \_\_\_\_\_ 5. On the grid in the figure that illustrates motion in a two-dimensional system, where is the starting reference point?
- a. one position to the right on the  $x$ -axis
  - b. where the  $x$ -axis meets the  $y$ -axis
  - c. one position to the left on the  $x$ -axis
  - d. one position up on the  $y$ -axis

**Directed Reading A *continued***

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- \_\_\_\_\_ 6. How would the motion of an object moving to the right be described in reference to a two-dimensional grid?
- a. in the positive direction on the  $y$ -axis
  - b. in the negative direction on the  $y$ -axis
  - c. in the negative direction on the  $x$ -axis
  - d. in the positive direction on the  $x$ -axis

**AVERAGE SPEED**

Use the terms from the following list to complete the sentences below.

average speed                  meters                  speed

7. The rate at which an object moves is its \_\_\_\_\_.
8. The total distance traveled divided by the total time taken to travel is called \_\_\_\_\_.
9. One way to express speed is with the SI unit of \_\_\_\_\_ per second.

**Making a Graph Showing Speed**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 10. Distance units are plotted on the  $y$ -axis of a graph showing speed. Which of the following is plotted on the  $x$ -axis?
- a. meters
  - b. speed
  - c. motion
  - d. time

**Recognizing Speed on a Graph**

- \_\_\_\_\_ 11. Why might the distance traveled in a given second vary on a graph showing speed?
- a. because the speed is constant
  - b. because the speed is not constant
  - c. because there is no motion
  - d. because motion is constant

**VELOCITY: DIRECTION MATTERS**

- \_\_\_\_\_ 12. What is the speed of an object in a particular direction called?
- a. distance
  - b. speed
  - c. velocity
  - d. acceleration

**Directed Reading A *continued***

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**Speed Versus Velocity**

- \_\_\_\_\_ **13.** What is the difference between speed and velocity?
- a. Speed must include a direction.
  - b. Velocity must include a direction.
  - c. Speed and velocity are the same.
  - d. Velocity never includes a direction.
- \_\_\_\_\_ **14.** Which of the following could describe an airplane's velocity?
- a. 600 km/h
  - b. 600 mi/h
  - c. 600 km/h south
  - d. 600 south

**Changing Velocity**

- \_\_\_\_\_ **15.** What happens if an object's speed and/or direction changes?
- a. The object's velocity changes.
  - b. The object's starting point changes.
  - c. The object's reference point changes.
  - d. The object's SI units change.

**ACCELERATION**

**Use the terms from the following list to complete the sentences below.**

deceleration

acceleration

positive

negative

- 16.** The rate at which velocity changes over time is called \_\_\_\_\_.
- 17.** An increase in speed is sometimes called \_\_\_\_\_ acceleration.
- 18.** An decrease in speed is sometimes called \_\_\_\_\_ acceleration.
- 19.** Negative acceleration is also called \_\_\_\_\_.

**Directed Reading A *continued***

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**Circular Motion: Continuous Acceleration**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ **20.** What is the acceleration that occurs when an object moves at a constant speed in circular motion called?
- a.** velocity
  - b.** positive acceleration
  - c.** negative acceleration
  - d.** centripetal acceleration

**Recognizing Acceleration on a Graph**

- \_\_\_\_\_ **21.** What does positive acceleration look like on a graph of speed versus time?
- a.** a line sloping upward as time passes
  - b.** a line sloping downward as time passes
  - c.** a straight horizontal line
  - d.** a straight vertical line

# Directed Reading A

## Section: What Is a Force? (pp. 344–349)

Use the terms from the following list to complete the sentences below.

direction

force

newton

magnitude

1. In science, a push or a pull exerted on an object is called a(n) \_\_\_\_\_.
2. The two properties of force are \_\_\_\_\_ and \_\_\_\_\_.
3. The SI unit for force is called a(n) \_\_\_\_\_.

### FORCES ACTING ON OBJECTS

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 4. Which of the following can cause a change in an object's motion?
- a. magnitude
  - b. force
  - c. direction
  - d. no force
- \_\_\_\_\_ 5. What does a person sitting on a chair exert on the chair?
- a. speed
  - b. direction
  - c. no force
  - d. force
- \_\_\_\_\_ 6. Why doesn't the force you exert when sitting on a chair cause the chair to move?
- a. because the floor exerts an unbalancing force on the chair
  - b. because the floor exerts a balancing force on the chair
  - c. because the floor exerts no force on the chair
  - d. because the floor exerts too much force on the chair

### COMBINED EFFECT OF FORCES

- \_\_\_\_\_ 7. What is the combination of all forces acting on an object called?
- a. energy
  - b. net force
  - c. motion
  - d. heat



**Directed Reading A *continued***

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**Forces in the Same Direction**

- \_\_\_\_\_ 8. How do you find the net force when the two forces act in the same direction?
- a. The two forces are divided.
  - b. The two forces are multiplied.
  - c. The two forces are subtracted.
  - d. The two forces are added.

**Forces in Opposite Directions**

- \_\_\_\_\_ 9. How do you find the net force when the two forces act in opposite directions?
- a. Subtract the smaller force from the larger force.
  - b. Add the two forces.
  - c. Divide the larger force by the smaller force.
  - d. Multiply the forces.

**BALANCED FORCES: NO CHANGE IN MOTION**

- \_\_\_\_\_ 10. Which of the following will not cause a change in the motion of an object?
- a. newtons
  - b. net forces
  - c. unbalanced forces
  - d. balanced forces
- \_\_\_\_\_ 11. When the forces on an object are balanced, what is the net force?
- a. 0 N
  - b. 1 N
  - c. 2 N
  - d. 3 N
- \_\_\_\_\_ 12. What force balances the force of gravity on a hanging light?
- a. compression
  - b. tension
  - c. velocity
  - d. net force

**Directed Reading A *continued***

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**Use the terms from the following list to complete the sentences below.**

balanced                      compression                      tension

**13.** When matter is pulled or stretched, the resulting force is called

\_\_\_\_\_.

**14.** When matter is pushed or squeezed, the resulting force is called

\_\_\_\_\_.

**15.** Static objects that have only \_\_\_\_\_ forces acting on them will not start moving.

**UNBALANCED FORCES: VELOCITY CHANGES**

**Use the terms from the following list to complete the sentences below.**

velocity    force  
unbalanced    static

**16.** When the forces on an object are \_\_\_\_\_, the net force on the object is not 0 N.

**17.** Unbalanced forces are needed to change the \_\_\_\_\_ of moving objects.

**18.** Unbalanced forces will cause \_\_\_\_\_ objects to start moving.

**19.** Every moving object started moving because an unbalanced \_\_\_\_\_ acted on it.

**Unbalanced Forces and Direction of Motion**

**Write the letter of the correct answer in the space provided.**

\_\_\_\_\_ **20.** How often do objects move in the direction of the unbalanced force?

- a. always
- b. never
- c. sometimes
- d. rarely

\_\_\_\_\_ **21.** Which of the following shows that an object can move in a different direction from the direction of an unbalanced force acting on it?

- a. kicking a soccer ball
- b. rolling a ball downhill
- c. twirling a ball on a string
- d. hitting a volleyball

## Skills Worksheet

**Directed Reading A****Section: Friction: A Force That Opposes Motion** (pp. 350–355)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which of the following is a force that opposes motion between two surfaces that are in contact?
- a. push
  - b. gravity
  - c. friction
  - d. thrust

**THE SOURCE OF FRICTION**

- \_\_\_\_\_ 2. Which of the following is created when the hills and valleys of two surfaces stick to each other?
- a. balanced force
  - b. velocity
  - c. gravity
  - d. friction
- \_\_\_\_\_ 3. Which of the following can be said about the magnitude of friction between two surfaces?
- a. The magnitude of friction doesn't depend on anything.
  - b. The magnitude of friction depends on many factors.
  - c. The magnitude of friction is always constant.
  - d. There is no magnitude of friction.

**The Effect of Force on Friction**

- \_\_\_\_\_ 4. If the force pushing surfaces together increases, which of the following occurs?
- a. The closer contact increases the friction.
  - b. The closer contact decreases the friction.
  - c. The friction stays the same.
  - d. Friction is not involved.

**The Effect of Material on Friction**

- \_\_\_\_\_ 5. Friction is usually greater between materials that have what type of surfaces?
- a. large
  - b. rough
  - c. smooth
  - d. small

**Directed Reading A *continued***

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- \_\_\_\_\_ 6. Why is the magnitude of friction between a table-tennis ball and a wood floor small?
- a. because the floor has a smooth surface
  - b. because the floor has a large surface area
  - c. because the floor has a rough surface
  - d. because the floor has a small surface area

**TYPES OF FRICTION**

- \_\_\_\_\_ 7. What are the two main types of friction?
- a. smooth and rough
  - b. kinetic and static
  - c. light and heavy
  - d. moving and nonmoving

**Kinetic Friction**

Use the terms from the following list to complete the sentences below.

rolling

moving

sliding

8. The type of friction observed between \_\_\_\_\_ surfaces is called kinetic friction.
9. The type of friction used to write with a pencil is called \_\_\_\_\_ kinetic friction.
10. Transportation that has wheels uses \_\_\_\_\_ kinetic friction.

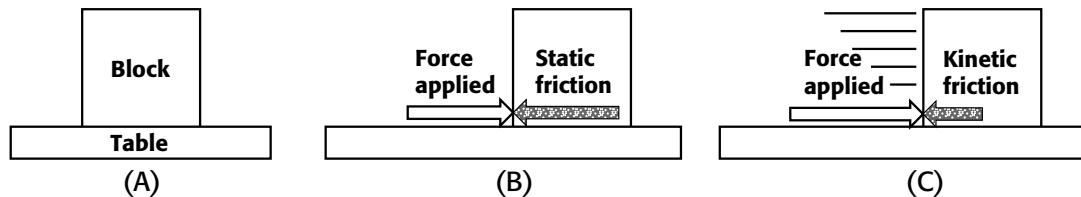
**Static Friction**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 11. What kind of friction exists when a force does not cause an object to move?
- a. static
  - b. kinetic
  - c. sliding
  - d. rolling
- \_\_\_\_\_ 12. What happens to static friction as soon as an object starts moving?
- a. It increases.
  - b. It decreases.
  - c. It stays the same.
  - d. It is replaced by kinetic friction.

**Directed Reading A *continued***

Use the figures below to answer questions 13, 14, and 15. Write the letter of the correct answer in the space provided.



- \_\_\_\_\_ 13. Look at Figure A above. Why does the block not move?
- because no force is applied
  - because of the force of friction
  - because of static friction
  - because of kinetic friction
- \_\_\_\_\_ 14. Look at Figure B above. The block does not move. What force keeps the block from moving?
- rolling kinetic friction
  - sliding kinetic friction
  - static friction
  - kinetic friction
- \_\_\_\_\_ 15. Look at Figure C above. The block is moving. What force acts against the block's motion?
- static friction
  - sliding kinetic friction
  - rolling kinetic friction
  - gravity

**FRICTION: HARMFUL AND HELPFUL**

- \_\_\_\_\_ 16. What is one way that friction by wind and water can be harmful?
- Friction causes erosion.
  - Friction causes disease.
  - Friction causes overwatering.
  - Friction causes drought.
- \_\_\_\_\_ 17. What would happen if you tried to walk without friction?
- You would change direction.
  - You would get lost.
  - You would slip and fall.
  - You would go slower.

**Directed Reading A *continued***

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**Ways to Reduce Friction**

- \_\_\_\_\_ **18.** What does a lubricant do?
- a.** increases friction between surfaces
  - b.** reduces friction between surfaces
  - c.** increases force between surfaces
  - d.** reduces force between surfaces
- \_\_\_\_\_ **19.** What can be used to reduce friction between the wheels and axles of bicycles?
- a.** sandpaper
  - b.** brakes
  - c.** dirt
  - d.** ball bearings

**Ways to Increase Friction**

- \_\_\_\_\_ **20.** How does sand on an icy road keep cars from sliding?
- a.** It makes the surface rougher.
  - b.** It makes the surface smoother.
  - c.** It makes the surface hotter.
  - d.** It makes the surface steeper.
- \_\_\_\_\_ **21.** What is one way to increase friction when you sand a piece of wood?
- a.** Freeze the wood.
  - b.** Use oil.
  - c.** Press harder.
  - d.** Use ball bearings.

# Vocabulary and Section Summary A

## Measuring Motion

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. motion

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2. average speed

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---

3. velocity

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4. acceleration

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### SECTION SUMMARY

Read the following section summary.

- An object is in motion if it changes position over time in relation to a reference point.
- Average speed is the total distance that an object travels divided by the total time that the object takes to travel that distance.
- Speed can be shown on a graph of position versus time.
- Velocity is speed as well as the direction of motion. The velocity of an object changes if the object's speed, direction, or both change.
- Acceleration is the rate at which velocity changes.
- An object can accelerate by changing speed, direction, or both.
- Acceleration can be shown on a graph of speed versus time.

# Vocabulary and Section Summary A

## What Is a Force?

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. force

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2. newton

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---

3. net force

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### SECTION SUMMARY

Read the following section summary.

- A force is a push or a pull. Forces have magnitude and direction and are expressed in newtons.
- Forces always act on objects.
- The combined effect of the forces acting on an object is the net force.
- Forces acting in the same direction are added. Forces acting in opposite directions are subtracted.
- Balanced forces cause no change in motion. The forces on a static object are balanced and can be identified.
- Unbalanced forces cause a change in velocity.



# Vocabulary and Section Summary A

## Friction: A Force That Opposes Motion

### VOCABULARY

In your own words, write a definition of the following term in the space provided.

1. friction

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### SECTION SUMMARY

Read the following section summary.

- Friction is a force that acts in a direction opposite to the direction of motion.
- Factors that affect the magnitude of friction include the force pushing the surfaces together and the materials that make up the surfaces.
- Kinetic friction is a force that, when unbalanced, can change the velocity of a moving object.
- Static friction can balance other forces and can prevent changes in motion.
- Friction can be helpful or harmful.

## Skills Worksheet

**Directed Reading A****Section: Gravity: A Force of Attraction** (pp. 370–375)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What is the force of attraction between objects due to their masses?
- a. magnetism
  - b. gravity
  - c. net force
  - d. natural force

**THE EFFECTS OF GRAVITY ON MATTER**

- \_\_\_\_\_ 2. Why is all matter affected by gravity?
- a. All matter has weight.
  - b. All matter has size.
  - c. All matter has volume.
  - d. All matter has mass.
- \_\_\_\_\_ 3. Why don't you notice smaller objects move toward each other due to gravity?
- a. The distance is too small.
  - b. The distance is too large.
  - c. Their masses are too small.
  - d. Their masses are too large.

**Earth's Gravitational Force**

- \_\_\_\_\_ 4. What force must be overcome to lift objects or parts of your body?
- a. magnetic force
  - b. gravitational force
  - c. net force
  - d. natural force

**NEWTON AND THE STUDY OF GRAVITY****The Core of an Idea**

- \_\_\_\_\_ 5. What unbalanced force did Newton conclude makes an apple fall?
- a. magnetism
  - b. gravity
  - c. net force
  - d. natural force

## Directed Reading A *continued*

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- \_\_\_\_\_ 6. What unbalanced force did Newton conclude makes the moon circle Earth?
- a. magnetism
  - b. gravity
  - c. net force
  - d. natural force

### The Birth of a Law

- \_\_\_\_\_ 7. What law describes how gravitational force, mass, and distance are related?
- a. the law of conservation of gravity
  - b. the law of conservation of mass
  - c. the law of universal gravitation
  - d. the law of universal mass
- \_\_\_\_\_ 8. What does the law of universal gravitation apply to?
- a. everything in the universe
  - b. only to Earth
  - c. only to outer space
  - d. only to the solar system

## THE LAW OF UNIVERSAL GRAVITATION

### Part 1: Gravitational Force and Mass

- \_\_\_\_\_ 9. What happens to gravitational force as the mass of things increases?
- a. It disappears.
  - b. It decreases.
  - c. It increases.
  - d. It stays the same.

### Part 2: Gravitational Force and Distance

- \_\_\_\_\_ 10. Why doesn't the sun's gravitational force affect you more than Earth's does?
- a. The sun has more velocity.
  - b. Earth has more air pressure.
  - c. Earth is moving faster.
  - d. The sun is much farther away.
- \_\_\_\_\_ 11. What happens to the gravitational force between two objects that move farther apart?
- a. It increases.
  - b. It decreases.
  - c. It does not change.
  - d. It changes at random.

**Directed Reading A *continued***

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**WEIGHT AND GRAVITATIONAL FORCE**

- \_\_\_\_\_ 12. What is the measure of the gravitational force on an object called?
- a. temperature
  - b. distance
  - c. weight
  - d. mass

**The Differences Between Weight and Mass**

- \_\_\_\_\_ 13. What is the amount of matter in an object called?
- a. temperature
  - b. distance
  - c. weight
  - d. mass
- \_\_\_\_\_ 14. What happens to an object's mass when gravitational force is increased?
- a. It increases and then decreases.
  - b. It does not change.
  - c. It increases.
  - d. It decreases.
- \_\_\_\_\_ 15. What happens to an object if it is moved from Earth to Jupiter?
- a. Its weight and mass increase.
  - b. Its weight and mass decrease.
  - c. Its weight increases and mass remains the same.
  - d. Its mass increases and weight remains the same.
- \_\_\_\_\_ 16. About how much is the moon's gravitational force compared to Earth's?
- a. one-sixth
  - b. one-third
  - c. one-half
  - d. one-quarter

**GRAVITY AND STATIC OBJECTS**

- \_\_\_\_\_ 17. What is a static object?
- a. a moving object
  - b. a nonmoving object
  - c. a weightless object
  - d. a massless object
- \_\_\_\_\_ 18. Why doesn't a static object move downward?
- a. Gravity on the object is balanced by an upward force.
  - b. Gravity does not pull on static objects.
  - c. Static objects don't have weight.
  - d. Static objects don't have mass.

## Skills Worksheet

**Directed Reading A****Section: Gravity and Motion** (pp. 376–383)**GRAVITY AND FALLING OBJECTS**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which scientist first thought that the amount of time it takes an object to fall does not depend on the object's mass?
- a. Isaac Newton
  - b. Galileo Galilei
  - c. Albert Einstein
  - d. Marie Curie

**Gravity and Acceleration**

- \_\_\_\_\_ 2. Why do objects fall to the ground at the same rate?
- a. Their acceleration is the same.
  - b. Their masses are the same.
  - c. Their weights are the same.
  - d. Their sizes are the same.
- \_\_\_\_\_ 3. Why is a heavier object harder to accelerate than a lighter one?
- a. It has more mass.
  - b. It has less mass.
  - c. It is larger.
  - d. It is harder to throw.

**Acceleration and Changes in Velocity**

Match the correct description with the correct term. Write the letter in the space provided.

- \_\_\_\_\_ 4. the rate at which velocity changes over time      a.  $v = g \times t$
- \_\_\_\_\_ 5. the rate at which everything falls toward Earth      b. acceleration
- \_\_\_\_\_ 6. the change in velocity of a falling object      c.  $9.8 \text{ m/s}^2$

Match the correct description with the correct term. Write the letter in the space provided.

- \_\_\_\_\_ 7. the symbol for acceleration due to gravity      a.  $v$
- \_\_\_\_\_ 8. the symbol for the time an object takes to fall      b.  $g$
- \_\_\_\_\_ 9. the symbol for change in velocity      c.  $t$

**Directed Reading A *continued***

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**AIR RESISTANCE AND FALLING OBJECTS**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 10. What is the term for a force that works against the motion of objects through air?
- a. gravity
  - b. terminal velocity
  - c. free fall
  - d. air resistance
- \_\_\_\_\_ 11. Why does a flat sheet of paper fall more slowly than a crumpled sheet?
- a. Gravity exerts less force on a flat sheet.
  - b. The crumpled paper is heavier.
  - c. The flat paper is lighter.
  - d. The flat paper has more air resistance.

**Acceleration and Terminal Velocity**

**Match the correct description with the correct term. Write the letter in the space provided.**

- \_\_\_\_\_ 12. when only the force of gravity is acting on an object
- a. terminal velocity
  - b. free fall
- \_\_\_\_\_ 13. when a falling object stops accelerating

**PROJECTILE MOTION AND GRAVITY**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 14. When you throw something, what do you call its curved path?
- a. terminal velocity
  - b. projectile motion
  - c. terminal motion
  - d. projectile velocity

**Horizontal Movement**

- \_\_\_\_\_ 15. Why does the horizontal velocity of a ball remain the same after it leaves your hand?
- a. Your hand is still applying force to the ball.
  - b. There are no forces that can change the ball's horizontal velocity.
  - c. Your friend catches the ball before the horizontal velocity can change.
  - d. There is no force of gravity acting on the ball.

**Directed Reading A *continued***

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**Vertical Movement**

- \_\_\_\_\_ 16. What gives a ball vertical movement after it leaves your hand?
- a. gravity
  - b. air resistance
  - c. the force of your hand
  - d. projectile motion
- \_\_\_\_\_ 17. When you throw a ball, what pulls it down?
- a. acceleration
  - b. horizontal movement
  - c. air resistance
  - d. gravity
- \_\_\_\_\_ 18. If you want to hit a target, where should you aim?
- a. at the target
  - b. below the target
  - c. above the target
  - d. to either side of the target

**ORBITING AND GRAVITY**

- \_\_\_\_\_ 19. When is an object orbiting?
- a. When it reaches terminal velocity.
  - b. When it comes against air resistance.
  - c. When it is moving around another object in space.
  - d. When it moves in a straight line.
- \_\_\_\_\_ 20. The forward motion of an orbiting spacecraft combines with what other motion?
- a. backward motion
  - b. horizontal movement
  - c. terminal motion
  - d. free fall

**Orbiting and Centripetal Force**

- \_\_\_\_\_ 21. Which of the following is orbiting?
- a. a planet moving around the sun
  - b. a plane in flight
  - c. a balloon
  - d. a rocket flying straight up

**Directed Reading A** *continued*

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- \_\_\_\_\_ **22.** Which is NOT true of centripetal force?
- a.** It is an unbalanced force.
  - b.** It can hold objects in nearly circular paths.
  - c.** It pushes outward.
  - d.** It means “a force toward the center.”

**Gravity and the Solar System**

- \_\_\_\_\_ **23.** Which of the following helps maintain the shape of the solar system?
- a.** gravity
  - b.** terminal velocity
  - c.** air resistance
  - d.** upward force



# Directed Reading A

## Section: Newton's Laws of Motion (pp. 384–391)

### NEWTON'S FIRST LAW

#### Part 1: Objects at Rest

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which is an example of an object at rest?
- a. a jet flying overhead
  - b. a chair on a floor
  - c. a rabbit jumping
  - d. a ball hit by a bat

#### Part 2: Objects in Motion

- \_\_\_\_\_ 2. When will objects at rest not stay at rest?
- a. when there is no horizontal motion
  - b. when there is no vertical motion
  - c. when there is no friction
  - d. when objects are acted upon by unbalanced forces
- \_\_\_\_\_ 3. What happens to your body's motion when the bumper car you're riding in hits a stopped car?
- a. Your motion stops.
  - b. Your motion continues with less velocity.
  - c. Your motion continues with the same velocity.
  - d. Your motion continues with greater velocity.

#### Friction and Newton's First Law

- \_\_\_\_\_ 4. Why does a desk quickly stop moving after you push it across the floor?
- a. The natural state of the desk is at rest.
  - b. There is no longer a force acting on the desk.
  - c. A balanced force acts on the desk.
  - d. An unbalanced force acts on the desk.
- \_\_\_\_\_ 5. What unbalanced force acts on a desk as it slides across the floor?
- a. friction
  - b. gravity
  - c. the weight of the desk
  - d. the speed of the desk

## Directed Reading A *continued*

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### Inertia and Newton's First Law

- \_\_\_\_\_ 6. What is Newton's first law sometimes called?
- a. the law of friction
  - b. the law of unbalanced forces
  - c. the law of acceleration
  - d. the law of inertia
- \_\_\_\_\_ 7. Why do objects that are at rest stay at rest?
- a. friction
  - b. velocity
  - c. gravity
  - d. inertia
- \_\_\_\_\_ 8. Why do objects that are moving keep moving?
- a. friction
  - b. velocity
  - c. gravity
  - d. inertia

### Mass and Inertia

- \_\_\_\_\_ 9. What kind of thing has less inertia?
- a. something with a large mass
  - b. something with a small mass
  - c. something that is moving
  - d. something that is not moving

### NEWTON'S SECOND LAW OF MOTION

#### Part 1: Acceleration Depends on Mass

- \_\_\_\_\_ 10. Why does it take more force to accelerate a full cart than an empty one?
- a. The full cart has more mass.
  - b. The full cart is harder to steer.
  - c. The empty cart has more mass.
  - d. You run into air resistance.

#### Part 2: Acceleration and Force

- \_\_\_\_\_ 11. If you give a cart a harder push, what happens to its acceleration?
- a. It decreases.
  - b. It increases.
  - c. It stays the same.
  - d. It varies.

**Directed Reading A *continued***

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**NEWTON'S THIRD LAW OF MOTION**

- \_\_\_\_\_ 12. Which of the following is a simple way to describe Newton's third law of motion?
- a. Acceleration depends on force.
  - b. All forces act in pairs.
  - c. An object at rest remains at rest.
  - d. A moving object remains in motion.

**Force Pairs Applied to Objects**

- \_\_\_\_\_ 13. What would happen if action and reaction forces acted on the same object?
- a. The object would move forward.
  - b. The object would move backward.
  - c. The result cannot be predicted.
  - d. The object would not move.

**Action and Reaction Force Pairs**

- \_\_\_\_\_ 14. Which of the following statements about forces is NOT true?
- a. Forces act in pairs.
  - b. An exerted force always has a reaction force.
  - c. A force never acts by itself.
  - d. Some forces act alone.
- \_\_\_\_\_ 15. Which of the following is an example of an action and reaction force pair?
- a. gravity from the sun and Earth on a falling ball
  - b. the forces between a bat and ball
  - c. air resistance and gravity on a sky diver
  - d. gravity and friction on a sliding desk

**Noticing the Effects of a Reaction Force**

- \_\_\_\_\_ 16. When you drop a ball, what is the action force on the ball?
- a. the ball's gravity pulling on Earth
  - b. Earth's gravity pulling on the ball
  - c. friction between the ball and Earth
  - d. your weight
- \_\_\_\_\_ 17. When you drop a ball, what is the reaction force on the Earth?
- a. the ball's gravity pulling on Earth
  - b. Earth's gravity pulling on the ball
  - c. friction between the ball and Earth
  - d. your weight

# Vocabulary and Section Summary A

## Gravity: A Force of Attraction

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. gravity

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2. weight

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3. mass

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### SECTION SUMMARY

Read the following section summary.

- Gravity is a force of attraction between objects that is due to their masses. Gravity can be an unbalanced force that causes changes in velocity.
- Gravity holds the solar system together.
- The law of universal gravitation states that all objects attract each other through gravitational force and that the magnitude of this force depends on the objects' masses and the distance between them.
- Mass is the amount of matter in an object. Weight is a measure of the gravitational force on an object.
- Gravity is often balanced by elastic forces due to tension or compression.

# Vocabulary and Section Summary A

## Gravity and Motion

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. terminal velocity

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2. free fall

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3. projectile motion

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### SECTION SUMMARY

Read the following section summary.

- Gravity is the force that causes all objects on Earth to accelerate downward at a rate of  $9.8 \text{ m/s}^2$ .
- Air resistance slows the acceleration of falling objects. An object falls at its terminal velocity when the upward force of air resistance equals the downward force of gravity.
- An object is in free fall if gravity is the only force acting on it.
- Projectile motion is the curved path that an object follows when thrown or propelled near the surface of Earth.
- Projectile motion has two components: horizontal motion and vertical motion. Gravity affects only the vertical motion of projectile motion.
- Gravity provides the centripetal force that keeps objects in orbit.
- Gravity is the force that keeps the solar system together.

# Vocabulary and Section Summary A

## Newton's Laws of Motion

### VOCABULARY

In your own words, write a definition of the following term in the space provided.

1. inertia

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### SECTION SUMMARY

Read the following section summary.

- Newton's first law of motion states that the motion of an object will not change if the forces on it are balanced.
- Objects at rest will not move unless acted upon by an unbalanced force.
- Objects in motion will continue to move at a constant speed and in a straight line unless acted upon by an unbalanced force.
- Inertia is the tendency of matter to resist a change in motion. Mass is a measure of inertia.
- Newton's second law of motion states that the acceleration of an object depends on the mass of the object and the amount of force applied.
- The greater the mass of an object is, the greater the force needed to achieve the same acceleration.
- Newton's third law of motion states that whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first object.

## Skills Worksheet

**Directed Reading A****Section: Fluids and Pressure** (pp. 406–411)

Use the terms from the following list to complete the sentences below.

liquids                      fluid                      move

1. Any material that can flow and takes the shape of its container is called a(n) \_\_\_\_\_.
2. Fluids include \_\_\_\_\_ and gases.
3. Particles in a fluid can \_\_\_\_\_ past each other.

**FLUIDS AND PRESSURE**

Use the terms from the following list to complete the sentences below.

pressure                      force  
increases                      pascal

4. Pumping up a tire \_\_\_\_\_ the amount of air inside the tire.
5. The amount of force exerted on a given area is called \_\_\_\_\_.
6. The SI unit for pressure is the \_\_\_\_\_.
7. Pressure can be calculated by dividing \_\_\_\_\_ by area.

**Pressure and Bubbles**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 8. How do fluids exert pressure?
- a. toward the right only
  - b. toward the left only
  - c. toward the bottom and top only
  - d. evenly in all directions

**Directed Reading A *continued***

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**ATMOSPHERIC PRESSURE**

**Match the correct description with the correct term. Write the letter in the space provided.**

- |  |                                |
|--|--------------------------------|
| _____ 9. atmospheric pressure at sea level             | <b>a.</b> atmospheric pressure |
| _____ 10. layer of gases that surrounds Earth          | <b>b.</b> gravity              |
| _____ 11. caused by the weight of the atmosphere       | <b>c.</b> atmosphere           |
| _____ 12. force that holds Earth's atmosphere in place | <b>d.</b> 101,300 Pa           |

**Variation of Atmospheric Pressure**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 13. Where is atmospheric pressure the lowest?
- a.** at the top of Mount Everest
  - b.** at sea level
  - c.** in an airplane at 12,000 m
  - d.** at 150,000 m above sea level
- \_\_\_\_\_ 14. Where is the full pressure of the atmosphere exerted?
- a.** at the top of Mount Everest
  - b.** at sea level
  - c.** in an airplane at 12,000 m
  - d.** at 150,000 m above sea level

**Atmospheric Pressure and Depth**

- \_\_\_\_\_ 15. What happens to pressure as you go deeper in the atmosphere?
- a.** Pressure increases.
  - b.** Pressure decreases.
  - c.** Pressure stays the same.
  - d.** Pressure is not affected.

**Pressure Changes and Your Body**

- \_\_\_\_\_ 16. What happens to fluids in your body when atmospheric pressure changes?
- a.** The fluids adjust to equal pressure.
  - b.** The fluids maintain low pressure.
  - c.** The fluids maintain high pressure.
  - d.** The fluids don't react to pressure.



**Directed Reading A *continued***

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**WATER PRESSURE**

**Water Pressure and Depth**

- \_\_\_\_\_ 17. Which of the following does NOT affect the total pressure on a diver?
- a. water depth
  - b. water pressure
  - c. atmospheric pressure
  - d. total amount of fluid present

**Density and Water Pressure**

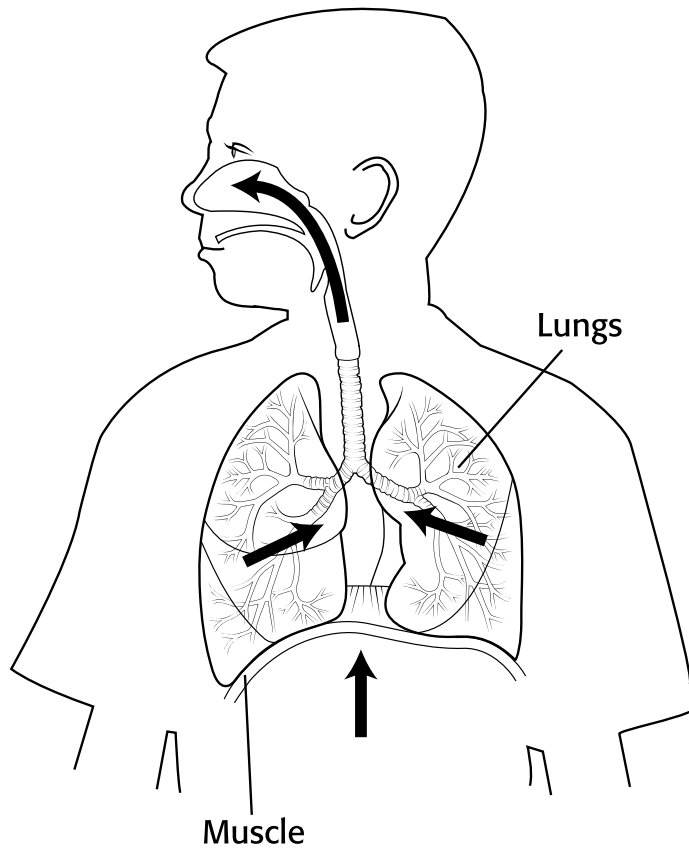
- \_\_\_\_\_ 18. How much more dense is water than air?
- a. 10 times
  - b. 100 times
  - c. 1,000 times
  - d. 8,000 times
- \_\_\_\_\_ 19. What is the amount of matter in a given volume called?
- a. pressure
  - b. fluid
  - c. density
  - d. depth
- \_\_\_\_\_ 20. Which of the following is NOT true?
- a. Water and air exert the same pressure.
  - b. Water weighs more than air.
  - c. Water exerts more pressure than air.
  - d. Water is more dense than air.

**PRESSURE DIFFERENCES AND FLUID FLOW**

- \_\_\_\_\_ 21. When you drink through a straw, how does the liquid move?
- a. through the atmosphere
  - b. from high to low pressure
  - c. from low to high pressure
  - d. through muscles

**Directed Reading A *continued*****Pressure Differences and Breathing**

Use the drawing below to answer questions 22 and 23. Write the letter of the correct answer in the space provided.



- \_\_\_\_\_ **22.** What happens when the muscle in your chest moves when you exhale?
- a.** The space in your chest increases.
  - b.** The space in your chest decreases.
  - c.** The air is pushed into your lungs.
  - d.** The pressure in your lungs decreases.
- \_\_\_\_\_ **23.** What happens in the lungs when you exhale?
- a.** The air moves from low pressure (outside) to high pressure (in the lungs).
  - b.** Lung pressure decreases.
  - c.** The space in your lungs increases.
  - d.** The air moves from high pressure (in the lungs) to low pressure (outside).

**Directed Reading A** *continued*

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**Pressure Differences and Tornadoes**

- \_\_\_\_\_ **24.** Why does air rush into a tornado?
- a.** Because air pressure is higher outside.
  - b.** Because air pressure is lower outside.
  - c.** Because air pressure is higher inside.
  - d.** Because air pressure is equal.
- \_\_\_\_\_ **25.** Which of the following is NOT an effect of tornadoes in nature?
- a.** tree damage
  - b.** building damage
  - c.** strong winds
  - d.** calm winds

Skills Worksheet

# Directed Reading A

## Section: Buoyancy and Density (pp. 412–419)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What is the upward force that fluids exert on all matter called?
- a. pascal force
  - b. atmospheric pressure
  - c. buoyant force
  - d. density

### BUOYANT FORCE AND FLUID PRESSURE

Use the terms from the following list to complete the sentences below.

weight                      depth                      Archimedes' principle

2. Pressure increases as \_\_\_\_\_ increases.
3. The principle used to determine buoyant force is called \_\_\_\_\_.
4. The buoyant force is determined by the \_\_\_\_\_ of the displaced water.

### WEIGHT VERSUS BUOYANT FORCE

Use the terms from the following list to complete the sentences below.

float                                      sink

5. An object that weighs more than the buoyant force on it will \_\_\_\_\_.
6. An object whose weight equals the buoyant force will \_\_\_\_\_.

### Sinking

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 7. Which of the following is true when a rock sinks in water?
- a. Buoyant force is less than the rock's weight.
  - b. Buoyant force equals the rock's weight.
  - c. Buoyant force is greater than the rock's weight.
  - d. There is no buoyant force on the rock.

**Directed Reading A *continued***

---

**Floating**

- \_\_\_\_\_ 8. Which of the following is true when a fish floats in water?
- a. Buoyant force is less than the fish's weight.
  - b. Buoyant force equals the fish's weight.
  - c. Buoyant force is greater than the fish's weight.
  - d. There is no buoyant force on the fish.

**Buoying Up**

- \_\_\_\_\_ 9. Which of the following is true when a duck is buoyed up in water?
- a. Buoyant force is less than the duck's weight.
  - b. Buoyant force equals the duck's weight.
  - c. Buoyant force is greater than the duck's weight.
  - d. There is no buoyant force on the duck.

**DENSITY AND FLOATING**

- \_\_\_\_\_ 10. What is density?
- a. mass per unit volume
  - b. volume per unit mass
  - c. weight per unit volume
  - d. volume per unit weight
- \_\_\_\_\_ 11. Why does a rock sink in water?
- a. The rock is denser than water.
  - b. Water is denser than the rock.
  - c. Air is denser than the rock.
  - d. Water is less dense than air.

**More Dense Than Air**

- \_\_\_\_\_ 12. Why don't most substances float in air?
- a. Air is too dense.
  - b. Most substances are denser than air.
  - c. Air weighs too much.
  - d. The volume of the atmosphere is too great.

**Less Dense Than Air**

- \_\_\_\_\_ 13. Which of the following is less dense than air?
- a. water
  - b. ice
  - c. helium
  - d. a duck

**Directed Reading A *continued***

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**DETERMINING DENSITY**

- \_\_\_\_\_ 14. What do you need to find an object's density?
- a. its pressure and volume
  - b. its mass and volume
  - c. its height and weight
  - d. its weight and pressure

**Volume of a Regular Solid**

- \_\_\_\_\_ 15. How do you find the volume of a regular solid?
- a. Add the lengths of the sides.
  - b. Multiply the lengths of the sides.
  - c. Divide the lengths by 2.
  - d. Measure the volume of air displaced.

**Volume of an Irregular Solid**

- \_\_\_\_\_ 16. How do you find the volume of an irregular solid?
- a. Add the lengths of the sides.
  - b. Multiply the lengths of the sides.
  - c. Divide the lengths by 2.
  - d. Measure the volume of water displaced.

**CHANGING OVERALL DENSITY****Changing the Shape**

- \_\_\_\_\_ 17. Which of the following features allows a ship to float?
- a. the ship's passengers
  - b. the ship's shape
  - c. the ship's hull
  - d. the ship's material
- \_\_\_\_\_ 18. Which of the following increases when steel is shaped into a hollow form?
- a. the steel's weight
  - b. the steel's volume
  - c. the steel's density
  - d. the overall density

**Directed Reading A *continued***

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**Changing the Mass**

**Match the correct description with the correct term. Write the letter in the space provided.**

- |   |                              |
|---|------------------------------|
| _____ 19. air-filled ballast tanks                      | <b>a.</b> diving submarine   |
| _____ 20. open ballast tanks                            | <b>b.</b> rising submarine   |
| _____ 21. closed ballast tanks into which air is pumped | <b>c.</b> floating submarine |

**Changing the Volume**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 22. Which of the following is the organ that keeps some fish from sinking?
- a.** gills
  - b.** swim bladder
  - c.** lungs
  - d.** brain

# Vocabulary and Section Summary A

## Fluids and Pressure

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. fluid

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---

---

2. pressure

---

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---

3. pascal

---

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4. atmospheric pressure

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### SECTION SUMMARY

Read the following section summary.

- A fluid is any material that flows and that takes the shape of its container.
- Pressure is the amount of force exerted on a given area.
- Moving particles of matter create pressure by colliding with one another and with the walls of their container.
- Atmospheric pressure is the pressure caused by the weight of the atmosphere.
- Fluid pressure increases as depth increases.
- Because water is denser than air, water exerts more pressure than air does.
- Fluids flow from areas of high pressure to areas of low pressure.



# Vocabulary and Section Summary A

## Buoyancy and Density

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. buoyant force

---

---

---

2. Archimedes' principle

---

---

---

### SECTION SUMMARY

Read the following section summary.

- All fluids exert an upward force called *buoyant force*.
- Buoyant force is caused by differences in fluid pressure.
- Archimedes' principle states that the buoyant force on an object is equal to the weight of the fluid displaced by the object.
- Any object that is denser than the surrounding fluid will sink. An object that is less dense than the surrounding fluid will float.
- The overall density of an object can be changed by changing the object's shape, mass, or volume.

## Skills Worksheet

**Directed Reading A****Section: Stars** (pp. 436–443)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What do scientists study to learn about far away stars?
- a. gravity
  - b. starlight
  - c. space
  - d. continuous spectrum

**COLOR OF STARS**

- \_\_\_\_\_ 2. How do scientists tell if a star is warm or cool?
- a. by its size
  - b. by its age
  - c. by its color
  - d. by its shape
- \_\_\_\_\_ 3. Which star is the coolest?
- a. a red star
  - b. a white star
  - c. a blue star
  - d. a blue-white star
- \_\_\_\_\_ 4. Which star is the warmest?
- a. a red star
  - b. a yellow star
  - c. a blue star
  - d. an orange star

**COMPOSITION OF STARS**

- \_\_\_\_\_ 5. What band of colors is made by white light passing through a glass prism?
- a. a spectrum
  - b. ultraviolet light
  - c. a wavelength
  - d. a color wheel
- \_\_\_\_\_ 6. What do astronomers use to separate a star's light into a spectrum?
- a. a telescope
  - b. a microscope
  - c. an oscilloscope
  - d. a spectroscope

**Directed Reading A *continued***

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**Types of Spectra**

Use the terms from the following list to complete the sentences below.

continuous spectrum                      emission lines

7. A spectrum that shows all the colors is called a(n)

\_\_\_\_\_.

8. Hot gases emit wavelengths of light, or colors, called

\_\_\_\_\_.

**Trapping the Light: Cosmic Detective Work**

Write the letter of the correct answer in the space provided.

\_\_\_\_\_ 9. What kind of light is made by the center of a star?

- a. blue light
- b. yellow light
- c. red light
- d. white light

\_\_\_\_\_ 10. What happens to light in the atmosphere of a star?

- a. Colors are emitted.
- b. Colors are absorbed.
- c. Colors are removed.
- d. Colors are added.

\_\_\_\_\_ 11. What is the spectrum of a star called?

- a. an absorption spectrum
- b. a continuous spectrum
- c. an emission spectrum
- d. a nuclear spectrum

\_\_\_\_\_ 12. What colors are shown by black lines on a star's spectrum?

- a. colors given off in the atmosphere
- b. colors absorbed by the atmosphere
- c. colors not affected by the atmosphere
- d. colors added by the atmosphere

**Identifying Elements by Using Dark Lines**

\_\_\_\_\_ 13. What spectrum is used to help find elements in a star's atmosphere?

- a. an absorption spectrum
- b. a continuous spectrum
- c. an emission spectrum
- d. a nuclear spectrum

**Directed Reading A *continued***

---

**The Types of Elements in a Star**

- \_\_\_\_\_ 14. What elements are stars mostly made of?
- a. hydrogen and carbon
  - b. helium and iron
  - c. hydrogen and helium
  - d. carbon and iron
- \_\_\_\_\_ 15. Besides hydrogen and helium, what are the most common elements in stars?
- a. carbon, nitrogen, oxygen
  - b. calcium, iron, sodium
  - c. mercury, potassium, uranium
  - d. chlorine, nitrogen, oxygen

**CLASSIFYING STARS**

- \_\_\_\_\_ 16. How did early scientists group stars?
- a. by size
  - b. by age
  - c. by temperature
  - d. by elements

**Differences in Temperature**

- \_\_\_\_\_ 17. How do scientists now group stars?
- a. by size
  - b. by age
  - c. by temperature
  - d. by elements
- \_\_\_\_\_ 18. Which color star is the hottest?
- a. yellow
  - b. blue
  - c. orange
  - d. red

**Differences in Brightness**

- \_\_\_\_\_ 19. Before they had telescopes, what did astronomers call the brightest stars?
- a. first-magnitude stars
  - b. third-magnitude stars
  - c. fifth-magnitude stars
  - d. sixth-magnitude stars
- \_\_\_\_\_ 20. What kind of numbers are used for the magnitude of dim stars?
- a. positive numbers
  - b. negative numbers
  - c. whole numbers
  - d. prime numbers

**Directed Reading A *continued***

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- \_\_\_\_\_ 21. What kind of numbers are used for the magnitude of bright stars?
- a. positive numbers
  - b. negative numbers
  - c. whole numbers
  - d. prime numbers
- \_\_\_\_\_ 22. What is the magnitude of Sirius, the brightest star in the night sky?
- a. 14
  - b. -1.4
  - c. -9.8
  - d. 9.8

**HOW BRIGHT IS THAT STAR?**

**Apparent Magnitude**

Use the terms from the following list to complete the sentences below.

absolute magnitude

apparent magnitude

23. The brightness of a star as seen from Earth is \_\_\_\_\_.
24. The brightness a star would have 32.6 light-years from Earth is \_\_\_\_\_.

**DISTANCE TO THE STARS**

Use the terms from the following list to complete the sentences below.

parallax

light-year

25. The distance that light travels in one year is a(n) \_\_\_\_\_.
26. A star may seem to shift in place because of \_\_\_\_\_.

**MOTIONS OF STARS**

**The Apparent Motion of Stars**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 27. Why do the stars in the sky seem to circle Polaris?
- a. Earth rotates.
  - b. The stars rotate.
  - c. Polaris rotates.
  - d. Earth stays in one place.

**The Actual Motion of Stars**

- \_\_\_\_\_ 28. Why is it hard to see stars move?
- a. Stars move too slowly.
  - b. Stars move too fast.
  - c. Stars are too far away.
  - d. Stars are too close.

## Skills Worksheet

**Directed Reading A****Section: The Life Cycle of Stars** (pp. 444–449)**TYPES OF STARS**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Besides by mass, size, brightness, color, temperature, and composition, how are stars classified?
- a. by constellation
  - b. by age
  - c. by distance from Earth
  - d. by planetary system
- \_\_\_\_\_ 2. What happens to the classification of a star as its properties change?
- a. Its classification never changes.
  - b. It stops being classified.
  - c. Its classification changes twice.
  - d. Its classification changes.

**THE LIFE CYCLE OF SUNLIKE STARS**

Use the terms from the following list to complete the sentences below.

- \_\_\_\_\_ 3. gravity first pulls dust and gas into a sphere
- \_\_\_\_\_ 4. the longest stage of a star's life cycle
- \_\_\_\_\_ 5. the center of a star shrinks, and its atmosphere grows very large
- \_\_\_\_\_ 6. the leftover center of a red giant
- a. red giant
  - b. white dwarf
  - c. protostar
  - d. main sequence

**A TOOL FOR STUDYING STARS**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 7. What diagram shows how a star's temperature and absolute magnitude are related?
- a. the main-sequence diagram
  - b. the Danish diagram
  - c. the H-A diagram
  - d. the H-R diagram
- \_\_\_\_\_ 8. What is one thing scientists can tell from the H-R diagram?
- a. Stars never change over time.
  - b. Stars change over time.
  - c. All stars are getting brighter.
  - d. All stars are getting hotter.

**Directed Reading A *continued***

---

**The H-R Diagram**

- \_\_\_\_\_ **9.** What appears along the bottom of the H-R diagram?  
**a.** temperature  
**b.** brightness  
**c.** size  
**d.** age
- \_\_\_\_\_ **10.** What appears along the left side of the H-R diagram?  
**a.** temperature  
**b.** brightness  
**c.** size  
**d.** age
- \_\_\_\_\_ **11.** Where do stars spend most of their lifetimes on the H-R diagram?  
**a.** lower right  
**b.** upper left  
**c.** lower left  
**d.** main sequence
- \_\_\_\_\_ **12.** What kind of pattern is the main sequence?  
**a.** horizontal  
**b.** circular  
**c.** diagonal  
**d.** spiral

**Match the correct description with the correct term. Write the letter in the space provided.**

- |  |                            |
|--|----------------------------|
| _____ <b>13.</b> top of the H-R diagram        | <b>a.</b> hot (blue) stars |
| _____ <b>14.</b> bottom of the H-R diagram     | <b>b.</b> cool (red) stars |
| _____ <b>15.</b> right side of the H-R diagram | <b>c.</b> dim stars        |
| _____ <b>16.</b> left side of the H-R diagram  | <b>d.</b> bright stars     |

**Directed Reading A *continued***

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**THE AGING OF MASSIVE STARS**

**Use the terms from the following list to complete the sentences below.**

pulsar

supernova

black hole

neutron star

**17.** A huge explosion in which a large star collapses is called a(n)

\_\_\_\_\_.

**18.** A star that collapses into a small and dense ball of neutrons is a(n)

\_\_\_\_\_.

**19.** A spinning neutron star that sends out beams of radiation is a(n)

\_\_\_\_\_.

**20.** An object so massive and dense that light cannot escape its gravity is a(n)

\_\_\_\_\_.



## Skills Worksheet

**Directed Reading A****Section: Galaxies** (pp. 450–453)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What are large groups of stars, dust, and gas held together by gravity?
- a. planetary systems
  - b. supernovas
  - c. asteroids
  - d. galaxies

**TYPES OF GALAXIES**

Match the correct description with the correct term. Write the letter in the space provided.

- |  |               |
|--|---------------|
| _____ 2. galaxy type with a bulge at the center and spiral arms  | a. elliptical |
| _____ 3. spiral galaxy where the sun and Earth are located       | b. irregular  |
| _____ 4. round or oval galaxies; called “cosmic snowballs”       | c. spiral     |
| _____ 5. galaxy type without a definite shape; stars form slowly | d. Milky Way  |

**CONTENTS OF GALAXIES****Gas Clouds**

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 6. What is a large cloud of gas and dust where stars are born?
- a. spherical halo
  - b. nebula
  - c. cluster
  - d. planetary system

**Star Clusters**

- \_\_\_\_\_ 7. What is a tight group of stars that looks like a ball?
- a. spherical halo
  - b. nebula
  - c. globular cluster
  - d. open cluster

**Directed Reading A** *continued*

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- \_\_\_\_\_ **8.** What is a relatively close group of stars along the disk of a spiral galaxy?
- a.** spherical halo
  - b.** nebula
  - c.** globular cluster
  - d.** open cluster

**QUASARS**

- \_\_\_\_\_ **9.** What is a starlike source of energy in the center of a galaxy?
- a.** a nebula
  - b.** a quasar
  - c.** a cluster
  - d.** a Magellanic Cloud
- \_\_\_\_\_ **10.** What do some scientists think caused quasars?
- a.** massive explosions
  - b.** massive black holes
  - c.** massive nebulas
  - d.** massive supernovas

**ORIGIN OF GALAXIES**

- \_\_\_\_\_ **11.** Why is looking through a telescope like looking back in time?
- a.** Galaxies travel in time.
  - b.** Light takes time to travel.
  - c.** Stars travel in time.
  - d.** Galaxies change over time.
- \_\_\_\_\_ **12.** What do scientists study to learn about the early universe?
- a.** nearby galaxies
  - b.** far galaxies
  - c.** spiral galaxies
  - d.** the sun

## Directed Reading A

### Section: Formation of the Universe (pp. 454–457)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What is the study of the universe called?
- a. planetology
  - b. cosmography
  - c. astronomy
  - d. cosmology

### THE BIG BANG THEORY

- \_\_\_\_\_ 2. What have scientists learned by studying the movement of galaxies?
- a. The universe is not moving.
  - b. Galaxies are moving apart.
  - c. Galaxies are moving together.
  - d. The universe is getting smaller.
- \_\_\_\_\_ 3. What standard model do scientists use to explain the expansion of the universe?
- a. the big bang theory
  - b. the theory of universe expansion
  - c. the theory of cosmology
  - d. the theory of fundamental forces

### A Tremendous Explosion

- \_\_\_\_\_ 4. According to the big bang theory, how did the universe begin?
- a. as a cloud of gases
  - b. as a sea of gases
  - c. with a small explosion
  - d. with a big explosion
- \_\_\_\_\_ 5. According to the big bang theory, how long ago did the universe begin?
- a. about 100 billion years ago
  - b. about 14 billion years ago
  - c. about 10 billion years ago
  - d. about 1 million years ago

**Directed Reading A *continued***

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**Cosmic Background Radiation**

- \_\_\_\_\_ 6. What is the energy in space left over from the big bang called?
- a. cosmic background radiation
  - b. cosmic background energy
  - c. space background radiation
  - d. background radio noise
- \_\_\_\_\_ 7. Where in space did the big bang send cosmic background radiation?
- a. only to the solar system
  - b. only to the closest galaxies
  - c. in every direction
  - d. only to the center of the universe

**GRAVITY AND THE UNIVERSE**

- \_\_\_\_\_ 8. After the big bang, what caused matter to form galaxies?
- a. random chance
  - b. magnetism
  - c. gravity
  - d. nuclear fusion
- \_\_\_\_\_ 9. How does gravity control the size and shape of the universe?
- a. Gravity pulls galaxies together.
  - b. Gravity pushes galaxies apart.
  - c. Gravity makes hydrogen explode.
  - d. Gravity makes atoms unstable.

**A Cosmic Repetition**

- \_\_\_\_\_ 10. What is every object in the universe a part of?
- a. a larger system
  - b. a smaller system
  - c. a solar system
  - d. a planetary system
- \_\_\_\_\_ 11. What is one other system the Milky Way galaxy contains?
- a. the Andromeda galaxy
  - b. a galaxy cluster
  - c. our solar system
  - d. an elliptical galaxy

**Directed Reading A *continued***

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**HOW OLD IS THE UNIVERSE?**

- \_\_\_\_\_ **12.** What kind of stars are the oldest in the Milky Way galaxy?
- a.** blue stars
  - b.** yellow stars
  - c.** white dwarfs
  - d.** protostars
- \_\_\_\_\_ **13.** How old are the oldest white dwarf stars?
- a.** between 12 and 13 thousand years
  - b.** between 12 and 13 million years
  - c.** between 12 and 13 billion years
  - d.** between 12 and 13 trillion years

**A FOREVER-EXPANDING UNIVERSE?**

- \_\_\_\_\_ **14.** What makes up most of the total universe?
- a.** matter
  - b.** dark matter
  - c.** dark energy
  - d.** cosmic background radiation
- \_\_\_\_\_ **15.** What does dark energy seem to be doing?
- a.** helping the universe get smaller
  - b.** helping the universe expand
  - c.** helping the universe stay the same size
  - d.** helping a new universe begin
- \_\_\_\_\_ **16.** What do scientists think will happen if the universe expands forever?
- a.** Stars will never age.
  - b.** New stars will always be born.
  - c.** More galaxies will form.
  - d.** The universe will become cold and dark.

# Vocabulary and Section Summary A

## Stars

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. spectrum

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2. apparent magnitude

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3. absolute magnitude

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4. light-year

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5. parallax

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### SECTION SUMMARY

Read the following section summary.

- The color of a star depends on the temperature of the star. Blue stars are hottest. Red stars are coolest.
- The spectrum of a star shows which elements make up a star's atmosphere.
- Apparent magnitude is the brightness of a star as seen from Earth. Absolute magnitude is a measure of how bright a star would be if the star were 32.6 light-years from Earth.
- Astronomers use parallax and trigonometry to measure distances to stars that are close to Earth. They use light-years to describe those distances.
- Stars appear to move because of Earth's rotation. The actual motion of stars is hard to see because stars are so distant.

# Vocabulary and Section Summary A

## The Life Cycle of Stars

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. main sequence

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2. H-R diagram

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3. supernova

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### SECTION SUMMARY

Read the following section summary.

- New stars form from gas and dust, which are pulled into a sphere by gravity.
- Some types of stars include main-sequence stars, giants, super giants, and white dwarfs.
- Most stars, including the sun, are main-sequence stars.
- The H-R diagram shows the brightness of a star relative to the temperature of the star. It also shows the life cycle of stars.
- Massive stars can explode in a large, bright flash called a *supernova*. Their cores can change into neutron stars or black holes.

# Vocabulary and Section Summary A

## Galaxies

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. galaxy

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2. nebula

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### SECTION SUMMARY

Read the following section summary.

- Astronomers classify galaxies by shape. The three types of galaxies are spiral galaxies, elliptical galaxies, and irregular galaxies.
- Some galaxies contain nebulas and star clusters.
- A nebula is a cloud of gas and dust. A globular cluster is a highly concentrated group of stars. An open cluster is a group of stars that are relatively close together.
- Scientists look at distant galaxies to see what early galaxies looked like.



# Vocabulary and Section Summary A

## Formation of the Universe

### VOCABULARY

In your own words, write a definition of the following term in the space provided.

1. big bang theory

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### SECTION SUMMARY

Read the following section summary.

- According to the big bang theory, the universe began with a tremendous explosion about 14 billion years ago.
- The presence of cosmic background radiation helps support the big bang theory.
- Scientists use white dwarfs to estimate the age of the universe.
- The universe is composed of matter, dark matter, and dark energy.
- Scientists think that the universe may expand forever.

Skills Worksheet

## Directed Reading A

### Section: A Solar System Is Born (pp. 472–479)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. What do the planets of the solar system orbit around?
- a. many moons
  - b. many stars
  - c. the solar nebula
  - d. the sun

#### THE SOLAR NEBULA

- \_\_\_\_\_ 2. What are clouds in space called?
- a. planetesimals
  - b. black holes
  - c. protons
  - d. nebulas
- \_\_\_\_\_ 3. What are nebulas made up of?
- a. gases and planets
  - b. energy and light
  - c. gases and dust
  - d. minerals and rock
- \_\_\_\_\_ 4. What are the gases of a nebula made up of?
- a. hydrogen and helium
  - b. hydrogen and oxygen
  - c. carbon dioxide and helium
  - d. carbon dioxide and oxygen

#### Gravity Pulls Matter Together

- \_\_\_\_\_ 5. What are the gas and dust of a nebula made of?
- a. solids
  - b. liquids
  - c. matter
  - d. air
- \_\_\_\_\_ 6. What does gravity do to a nebula's matter?
- a. It holds the matter together.
  - b. It pulls the matter apart.
  - c. It makes the matter drift away.
  - d. It makes the matter stronger.

## Directed Reading A *continued*

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### Pressure Pushes Matter Apart

Use the terms from the following list to complete the sentences below.

pressure

temperature

7. A measure of the energy of motion of the particles in an object is

\_\_\_\_\_.

8. In a nebula, \_\_\_\_\_ balances the inward gravitational pull and keeps the cloud from collapsing.

### UPSETTING THE BALANCE

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 9. Which of the following describes the solar nebula?
- a. boulders and asteroids
  - b. the cloud that formed our solar system
  - c. fused hydrogen atoms
  - d. the four planets closest to the sun

### HOW THE SOLAR SYSTEM FORMED

- \_\_\_\_\_ 10. What caused the solar system to form?
- a. Gravity became weaker.
  - b. Pressure became weaker.
  - c. The solar nebula collapsed.
  - d. The solar nebula exploded.

### From Planetesimals to Planets

- \_\_\_\_\_ 11. How did particles in the nebula make planetesimals?
- a. They collided.
  - b. They became solid.
  - c. They expanded from heat.
  - d. They formed a sphere.
- \_\_\_\_\_ 12. What are planetesimals?
- a. small nebulas
  - b. small bodies
  - c. light gases
  - d. new stars
- \_\_\_\_\_ 13. What did the protoplanets eventually become?
- a. the solar nebula
  - b. stars
  - c. the sun
  - d. planets and moons

**Directed Reading A *continued***

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- \_\_\_\_\_ 14. Which of the following describes the sun, the planets, and most moons?
- a. spherical
  - b. square
  - c. rectangular
  - d. triangular

**The Birth of a Star**

- \_\_\_\_\_ 15. What formed at the center of the solar nebula?
- a. planetesimals
  - b. Earth
  - c. moons
  - d. the sun
- \_\_\_\_\_ 16. What happened when hydrogen atoms began to fuse to form helium?
- a. The nebula exploded.
  - b. The gas left the nebula.
  - c. The gas stopped collapsing.
  - d. The helium atoms divided.

**THE STRUCTURE OF THE SUN**

- \_\_\_\_\_ 17. Which of the following is NOT part of the sun's interior?
- a. the corona
  - b. the core
  - c. the radiative zone
  - d. the convective zone
- \_\_\_\_\_ 18. Which of the following is NOT part of the sun's atmosphere?
- a. the corona
  - b. the convective zone
  - c. the chromosphere
  - d. the photosphere

**ENERGY PRODUCTION IN THE SUN**

- \_\_\_\_\_ 19. According to Einstein's formula, what can matter change into?
- a. pressure
  - b. temperature
  - c. gravity
  - d. energy

**Directed Reading A *continued***

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**Nuclear Fusion**

- \_\_\_\_\_ **20.** Which of the following is the process by which the sun generates energy?
- a.** nebula collision
  - b.** star illumination
  - c.** nuclear fusion
  - d.** rotating clouds

**Conditions Required for Fusion**

- \_\_\_\_\_ **21.** What condition in the center of the sun allows fusion to happen?
- a.** The temperature and pressure are very high.
  - b.** Gravity and pressure interact.
  - c.** The nuclei are negatively charged.
  - d.** There is no balance between gravity and pressure.

**Fusion in the Sun**

- \_\_\_\_\_ **22.** Which of the following is released during fusion of hydrogen of the sun?
- a.** dust
  - b.** gravity
  - c.** energy
  - d.** clouds

**MEASURING INTERPLANETARY DISTANCES**

**Match the correct description with the correct term. Write the letter in the space provided.**

- \_\_\_\_\_ **23.** the average distance between the sun and Earth
- \_\_\_\_\_ **24.** the distance that light travels in a minute
- a.** light-minute
  - b.** astronomical unit

**THE INNER AND OUTER SOLAR SYSTEMS**

**Match the correct description with the correct term. Write the letter in the space provided.**

- \_\_\_\_\_ **25.** the four planets that are farthest from the sun
- \_\_\_\_\_ **26.** the four planets that are closest to the sun
- a.** inner solar system
  - b.** outer solar system

## Skills Worksheet

**Directed Reading A****Section: The Inner Planets** (pp. 480–485)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Why are the inner planets called *terrestrial planets*?
- a. because they are very hot
  - b. because they can support life
  - c. because most are gas giants
  - d. because they are very dense and rocky
- \_\_\_\_\_ 2. What three words could you use to describe the inner planets?
- a. hot, dry, and dense
  - b. small, dense, and rocky
  - c. large, light, and gaseous
  - d. small, light, and solid

**MERCURY: CLOSEST TO THE SUN**

- \_\_\_\_\_ 3. Which of the following planets is located closest to the sun?
- a. Mars
  - b. Venus
  - c. Earth
  - d. Mercury
- \_\_\_\_\_ 4. What is Mercury's interior composed of?
- a. hot gases
  - b. a large, iron core
  - c. oceans
  - d. ice

**Days and Years on Mercury**

- \_\_\_\_\_ 5. Why is Mercury's day equal to 59 Earth days?
- a. because Mercury's period of rotation is fast
  - b. because Mercury's period of rotation is slow
  - c. because Mercury's period of revolution is slow
  - d. because Mercury's period of revolution is fast
- \_\_\_\_\_ 6. How long does it take Mercury to revolve once around the sun?
- a. 55 Earth days
  - b. 150 Earth days
  - c. 88 Earth days
  - d. 220 Earth days

**Directed Reading A *continued***

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**Match the correct description with the correct term. Write the letter in the space provided.**

- |   |  |
|---|--|
| _____ 7. the time that an object takes to complete an orbit around another body | a. period of rotation<br>b. year         |
| _____ 8. the motion of a body orbiting another body in space                    | c. revolution<br>d. period of revolution |
| _____ 9. the time that a planet takes to go around the sun once                 |  |
| _____ 10. the amount of time that an object takes to rotate once                |  |

**VENUS: EARTH'S TWIN?**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 11. Why is the planet Venus sometimes called Earth's twin?
- a. Venus was born at the same time as Earth.
  - b. Venus shares Earth's orbit.
  - c. Venus has almost the same size, mass, and density as Earth.
  - d. Venus rotates in the same direction as Earth.
- \_\_\_\_\_ 12. Why does the sun rise in the west and set in the east on Venus?
- a. Venus has a retrograde rotation.
  - b. Venus has a prograde rotation.
  - c. Venus spins the same way as the sun.
  - d. Earth has a counterclockwise spin.

**Match the correct description with the correct term. Write the letter in the space provided.**

- |   |  |
|---|--|
| _____ 13. A planet appears to spin in a clockwise direction when viewed from above its North Pole.        | a. prograde rotation<br>b. retrograde rotation |
| _____ 14. A planet appears to spin in a counterclockwise direction when viewed from above its North Pole. |  |

**Directed Reading A *continued***

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**The Atmosphere of Venus**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 15. Which terrestrial planet has the densest atmosphere?
- a. Earth
  - b. Mars
  - c. Mercury
  - d. Venus
- \_\_\_\_\_ 16. Which of the following make up Venus's atmosphere?
- a. mainly oxygen and nitrogen
  - b. mainly carbon dioxide and acid
  - c. mainly hydrogen and helium
  - d. mainly water vapor and acids

**Mapping Venus's Surface**

- \_\_\_\_\_ 17. What technology was used to map Venus?
- a. survey tools
  - b. video
  - c. sonar
  - d. radar
- \_\_\_\_\_ 18. Which of the following physical features were NOT found on Venus?
- a. mountains
  - b. oceans
  - c. lava plains
  - d. volcanoes

**EARTH: AN OASIS IN SPACE**

**A Constantly Changing Planet**

- \_\_\_\_\_ 19. What makes Earth a suitable place for life?
- a. water and an energy source
  - b. carbon dioxide in the air
  - c. moving landmasses
  - d. cold temperatures

**Studying Earth from Space**

- \_\_\_\_\_ 20. Which of the following is NOT part of Earth's interrelated global system?
- a. the oceans
  - b. the stars
  - c. the atmosphere
  - d. ice



**Directed Reading A *continued***

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**MARS: THE RED PLANET**

**The Atmosphere of Mars**

- \_\_\_\_\_ 21. What makes Mars a cold planet?
- a. It has a thin atmosphere.
  - b. It is too close to the sun.
  - c. It has polar icecaps.
  - d. It has high air pressure.
- \_\_\_\_\_ 22. What is an important effect of Mars's low temperature and low air pressure?
- a. Volcanoes on Mars are active.
  - b. Mars's weather is always hot.
  - c. There is no liquid water on Mars.
  - d. The icecaps are made of carbon dioxide.

**Water on Mars**

- \_\_\_\_\_ 23. What evidence suggests that Mars once had liquid water?
- a. polar icecaps
  - b. features that look like water erosion
  - c. its thick atmosphere
  - d. mountains and volcanoes

**Where Is the Water Now?**

- \_\_\_\_\_ 24. Besides the polar icecaps, where might liquid water exist on Mars?
- a. in rivers on top of the soil
  - b. in the mountains
  - c. frozen beneath Mars's surface
  - d. in Mars's volcanoes

**Volcanoes on Mars**

- \_\_\_\_\_ 25. What is the name of the largest volcanic system on Mars?
- a. Mauna Kea
  - b. Olympus Mons
  - c. Sojourner
  - d. Tharsis Montes
- \_\_\_\_\_ 26. Why is Olympus Mons so high?
- a. It has erupted for a long period of time.
  - b. It is a shield volcano.
  - c. It is made of ice.
  - d. It has never erupted.

**Directed Reading A** *continued*

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**Missions to Mars**

\_\_\_\_\_ **27.** What are the *Mars Express Orbiter's* instruments searching for?

- a.** volcanoes
- b.** traces of water
- c.** the polar icecaps
- d.** mountains

\_\_\_\_\_ **28.** What did the *Spirit* and *Opportunity* find in 2004?

- a.** two large volcanic systems
- b.** the polar icecaps
- c.** evidence that water once existed
- d.** Olympus Mons

## Skills Worksheet

**Directed Reading A****Section: The Outer Planets** (pp. 486–491)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which of the following describes a gas giant?
- a. planets that have hard surfaces
  - b. planets that have snow and ice
  - c. planets that have massive gas atmospheres
  - d. planets that have no atmospheres
- \_\_\_\_\_ 2. Which outer body could NOT be called a gas giant?
- a. Neptune
  - b. Pluto
  - c. Saturn
  - d. Uranus

**JUPITER: A GIANT AMONG GIANTS**

- \_\_\_\_\_ 3. Which is the largest planet in our solar system?
- a. Jupiter
  - b. Earth
  - c. Saturn
  - d. Neptune
- \_\_\_\_\_ 4. What is Jupiter made of?
- a. mainly oxygen
  - b. mainly methane
  - c. mainly hydrogen
  - d. mainly carbon dioxide
- \_\_\_\_\_ 5. What is Jupiter's Great Red Spot?
- a. thick clouds
  - b. colorful compounds
  - c. metallic hydrogen
  - d. a huge storm
- \_\_\_\_\_ 6. What is unusual about Jupiter's energy supply?
- a. It gets energy from the Great Red Spot.
  - b. It gives off more energy than it takes in.
  - c. It gets energy from its moons.
  - d. It gets energy from a neutron star.

**Directed Reading A *continued***

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**The Exploration of Jupiter**

- \_\_\_\_\_ 7. What information did the Galileo mission's atmospheric probe send back about Jupiter?
- a. details about its weather
  - b. facts about its gases
  - c. images of its Great Red Spot
  - d. facts about its moons

**SATURN: THE RINGED WORLD**

- \_\_\_\_\_ 8. Which of the following is the second-largest planet in the solar system?
- a. Pluto
  - b. Neptune
  - c. Jupiter
  - d. Saturn
- \_\_\_\_\_ 9. Which of the following is true of Saturn's density?
- a. Saturn's density is higher than Jupiter's.
  - b. Saturn's density is more than the density of water.
  - c. Saturn is the least dense of all the planets.
  - d. Saturn is the most dense of all the planets.

**The Rings of Saturn**

- \_\_\_\_\_ 10. What are Saturn's rings made of?
- a. rocks and dust
  - b. iron and metals
  - c. water ice and dust
  - d. organic compounds

**The Exploration of Saturn**

- \_\_\_\_\_ 11. Which spacecraft reached Saturn in 2004 to study its rings and northern polar region?
- a. *Cassini*
  - b. *Galileo*
  - c. *Pioneer*
  - d. *Voyager*

**Directed Reading A *continued***

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**URANUS: A SMALL GIANT**

- \_\_\_\_\_ 12. What affect does the methane in its atmosphere have on Uranus?
- a. It causes Uranus to have rings.
  - b. It gives Uranus a greenish tinge.
  - c. It causes Uranus to have clouds.
  - d. It makes Uranus look blue.

**A Tilted Planet**

- \_\_\_\_\_ 13. What is unusual about Uranus's axis?
- a. The planet is tipped on its side.
  - b. The axis is tipped at an angle of 45°.
  - c. The axis is tipped at an angle of 65°.
  - d. The planet is straight up and down.
- \_\_\_\_\_ 14. What do scientists think may have caused Uranus's tilt?
- a. Uranus escaped Jupiter's gravity.
  - b. Uranus's moons had a cosmic tug of war.
  - c. Uranus was pulled by Saturn's gravity.
  - d. Uranus was hit by a large object.

**NEPTUNE: THE BLUE WORLD**

- \_\_\_\_\_ 15. What causes Neptune's blue color?
- a. methane in the atmosphere
  - b. rocks and ice
  - c. helium in the atmosphere
  - d. the Great Dark Spot

**The Weather on Neptune**

- \_\_\_\_\_ 16. What is the Great Dark Spot?
- a. gases in the atmosphere
  - b. a storm the size of Earth
  - c. a volcanic system
  - d. a polar icecap
- \_\_\_\_\_ 17. How fast do Neptune's winds travel?
- a. more than 100 m/s
  - b. less than 1,000 km/hr
  - c. approximately 300 km/s
  - d. more than 1,000 km/h

**Directed Reading A *continued***

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**PLUTO: A DWARF PLANET**

**A Small World**

- \_\_\_\_\_ 18. What is Pluto made of?
- a. hydrogen and helium
  - b. mainly organic compounds and ice
  - c. hydrogen and water
  - d. rock and ice
- \_\_\_\_\_ 19. What is unusual about Pluto's moon?
- a. Its orbit is not regular.
  - b. It is more than half the size of Pluto.
  - c. It is about the same size as Pluto.
  - d. It is denser than Pluto.

**Beyond Pluto**

- \_\_\_\_\_ 20. Which of the following is a region that contains small bodies made mostly of ice?
- a. Jupiter's interior
  - b. Pluto's atmosphere
  - c. the Kuiper belt
  - d. the Great Dark Spot
- \_\_\_\_\_ 21. What did scientists discover in the Kuiper belt in 2003?
- a. 2003UB313
  - b. Pluto
  - c. Charon
  - d. another sun

Skills Worksheet

# Directed Reading A

## Section: Moons (pp. 492–499)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which of these planets do not have moons?
- a. Mars and Mercury
  - b. Neptune and Uranus
  - c. Venus and Mars
  - d. Venus and Mercury

Use the terms from the following list to complete the sentences below.

moons

satellites

2. Natural or artificial bodies that revolve around larger bodies are called \_\_\_\_\_.
3. Most of the planets of our solar system have natural satellites called \_\_\_\_\_.

## LUNA: THE MOON OF EARTH

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 4. What is the approximate age of the lunar rocks brought back from the Apollo missions?
- a. 10 years old
  - b. 20 million years old
  - c. 4.5 billion years old
  - d. 50 billion years old

## The Surface of the Moon

- \_\_\_\_\_ 5. What is the moon's surface composed of?
- a. highlands and plains
  - b. oceans and rivers
  - c. volcanoes and highlands
  - d. mountains and oceans

## Lunar Origins

- \_\_\_\_\_ 6. What is the current theory about the birth of the moon?
- a. Earth's gravity trapped the moon.
  - b. A Mars-sized body collided with Earth.
  - c. A moon-sized body collided with Earth.
  - d. A piece of Earth spontaneously broke off.

**Directed Reading A *continued***

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- \_\_\_\_\_ 7. What facts support this theory?
- a. The moon is covered with craters.
  - b. The lunar maria are old lava flows.
  - c. The moon's composition is similar to that of Earth's mantle.
  - d. The impacting body has been identified.
- \_\_\_\_\_ 8. What caused the moon to become a sphere?
- a. gravity
  - b. atmosphere
  - c. gases
  - d. orbit

**Moonlight**

- \_\_\_\_\_ 9. Why does the moon shine?
- a. because it waxes and wanes
  - b. because of its period of revolution
  - c. because it generates energy
  - d. because it reflects the sun's light

**Phases of the Moon**

- \_\_\_\_\_ 10. What causes the moon to change its appearance each month?
- a. The moon reflects light from the sun.
  - b. The moon changes position as it revolves around Earth.
  - c. The moon orbits around the sun.
  - d. The sun's shadow falls on the moon.

**Use the terms from the following list to complete the sentences below.**

waning

phases

waxing

11. The different appearances of the moon as seen from Earth are called \_\_\_\_\_.
12. When the moon is \_\_\_\_\_, the sunlit part of the moon that we see from Earth is getting larger.
13. When the moon is \_\_\_\_\_, the sunlit part of the moon that we see from Earth is getting smaller.



**Directed Reading A *continued***

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**Eclipses****Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 14. What occurs when the shadow of one celestial body falls on another?
- a. waxing
  - b. a collision
  - c. an eclipse
  - d. a phase

**Match the correct description with the correct term. Write the letter in the space provided.**

- |   |                        |
|---|------------------------|
| _____ 15. The shadow of Earth falls on the moon.                      | a. solar eclipse       |
| _____ 16. The shadow of the moon falls on part of Earth.              | b. lunar eclipse       |
| _____ 17. A thin ring of the sun shows around the moon's outer edge.  | c. total solar eclipse |
| _____ 18. The disk of the moon completely covers the disk of the sun. | d. annular eclipse     |

**The Moon's Tilted Orbit****Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 19. Why don't we see eclipses every month?
- a. The moon's orbit is an ellipse.
  - b. The moon's orbit is tilted.
  - c. Earth's orbit around the sun changes.
  - d. Half of the moon is always in sunlight.

**THE MOONS OF OTHER PLANETS**

- \_\_\_\_\_ 20. Which of the following statements about moons is incorrect?
- a. Some orbit backward.
  - b. Many may be captured asteroids.
  - c. Some have very elliptical orbits.
  - d. None is as large as terrestrial planets.

**The Moons of Mars**

- \_\_\_\_\_ 21. What are the two moons of Mars?
- a. Ganymede and Io
  - b. Deimos and Luna
  - c. Phobos and Deimos
  - d. Charon and Phobos

**Directed Reading A *continued***

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**The Moons of Jupiter**

- \_\_\_\_\_ **22.** What are the four largest moons of Jupiter known as?
- a. Luna
  - b. the Galilean satellites
  - c. Terrae
  - d. the Maria moons
- \_\_\_\_\_ **23.** Ganymede is larger than which planet?
- a. Earth
  - b. Mars
  - c. Mercury
  - d. Venus
- \_\_\_\_\_ **24.** Which of the following is the most volcanically active body in the solar system?
- a. Jupiter
  - b. Callisto
  - c. Io
  - d. Europa
- \_\_\_\_\_ **25.** What suggests that Europa might contain life?
- a. Europa's surface is rocky.
  - b. Europa has many craters.
  - c. Europa has active geysers.
  - d. Europa may have an ocean.

**The Moons of Saturn**

- \_\_\_\_\_ **26.** How many moons does Saturn have?
- a. more than 50
  - b. 8
  - c. 14
  - d. 20
- \_\_\_\_\_ **27.** Which of the following statements does NOT describe Titan?
- a. It has an atmosphere 700 km thick.
  - b. Its atmosphere is mostly nitrogen.
  - c. It is Saturn's largest moon.
  - d. It has 100 active volcanoes.

**The Moons of Uranus**

- \_\_\_\_\_ **28.** Which of Uranus's moons re-formed in a mixed-up state?
- a. Charon
  - b. Callisto
  - c. Miranda
  - d. Phobos

**Directed Reading A** *continued*

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**The Moons of Neptune**

- \_\_\_\_\_ **29.** What is unusual about Neptune's largest moon, Triton?
- a.** It has oceans of water.
  - b.** It revolves around Neptune in a retrograde orbit.
  - c.** It has a thick atmosphere.
  - d.** Its orbit is tilted.

**The Moon of Pluto**

- \_\_\_\_\_ **30.** Why does one side of Pluto always face Charon?
- a.** Charon is large in comparison with Pluto.
  - b.** Charon was a captured asteroid or comet.
  - c.** Charon's period of revolution is equal to Pluto's period of rotation.
  - d.** Pluto is sometimes eclipsed by Charon.

## Directed Reading A

### Section: Small Bodies in the Solar System (pp. 500–505)

Write the letter of the correct answer in the space provided.

- \_\_\_\_\_ 1. Which of these objects would NOT be described as a small body?
- a. asteroids
  - b. meteoroids
  - c. comets
  - d. stars
- \_\_\_\_\_ 2. What can we learn by studying small bodies in the solar system?
- a. how to explore space in spacecraft
  - b. whether life exists on Mars
  - c. what the solar system is made of
  - d. what the temperature is in space

### COMETS

- \_\_\_\_\_ 3. What materials are comets made of?
- a. iron, nickel, and rock
  - b. ice, rock, and cosmic dust
  - c. lighter elements and water ice
  - d. frozen gases and metals
- \_\_\_\_\_ 4. What is the spherical cloud of gas and dust surrounding the nucleus of a comet called?
- a. asteroid
  - b. meteor
  - c. coma
  - d. planet

### Comet Tails

- \_\_\_\_\_ 5. What causes the tail of a comet to form?
- a. Sunlight causes the comet's ice to change to gas.
  - b. The comet orbits the sun.
  - c. The gravity of a passing star disturbs the Oort cloud.
  - d. Sunlight reflects off the tail.
- \_\_\_\_\_ 6. What is the ion tail of a comet made of?
- a. dust
  - b. gas
  - c. rock
  - d. ice

**Directed Reading A *continued***

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**Comet Orbits**

- \_\_\_\_\_ 7. Where do most comets come from?  
**a.** Earth's atmosphere  
**b.** the asteroid belt  
**c.** the Oort cloud and the Kuiper belt  
**d.** just beyond Mercury's orbit
- \_\_\_\_\_ 8. What kind of orbit do comets follow?  
**a.** spherical  
**b.** circular  
**c.** gravitational  
**d.** elliptical

**Long- and Short-Period Comets**

**Match the correct description with the correct term. Write the letter in the space provided.**

- \_\_\_\_\_ 9. comets that take less than 200 years to orbit the sun                      **a.** short-term comets  
**b.** long-terms comets
- \_\_\_\_\_ 10. comets that take more than 200 years to orbit the sun

**ASTEROIDS**

**Use the terms from the following list to complete the sentences below.**

asteroid belt    asteroid

11. A small, rocky body that revolves around the sun is called a(n) \_\_\_\_\_.
12. A region of space between the orbits of Mars and Jupiter is called the \_\_\_\_\_.

**Composition of Asteroids**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 13. What color are asteroids that are rich in carbon?  
**a.** black  
**b.** reddish brown  
**c.** dark gray  
**d.** light gray

**Directed Reading A *continued***

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**Near-Earth Asteroids**

- \_\_\_\_\_ 14. Which of the following statements describes near-Earth asteroids?
- a. They come from the Oort cloud.
  - b. They have an ion tail and a dust tail.
  - c. They are made of ice.
  - d. Their orbits bring them close to Earth.

**METEORIDS**

**Match the correct description with the correct term. Write the letter in the space provided.**

- |  |               |
|--|---------------|
| _____ 15. rocky bodies that reach Earth's surface                              | a. meteors    |
| _____ 16. glowing trails that result when bodies burn up in Earth's atmosphere | b. meteoroids |
| _____ 17. pieces of dust and debris from asteroids and comets                  | c. meteorites |

**Composition of Meteorites**

**Match the correct description with the correct term. Write the letter in the space provided.**

- |  |                         |
|--|-------------------------|
| _____ 18. may contain carbon-bearing compounds | a. metallic meteorite   |
| _____ 19. is rare and contains iron            | b. stony meteorite      |
| _____ 20. is distinctive and easy to find      | c. stony-iron meteorite |

**Meteor Showers**

**Write the letter of the correct answer in the space provided.**

- \_\_\_\_\_ 21. What causes meteor showers?
- a. small meteoroids entering Earth's atmosphere
  - b. the gravity of a nearby star or planet
  - c. water entering Earth's atmosphere from space
  - d. the activity of the solar wind

**Impacts on Earth**

- \_\_\_\_\_ 22. How often does an impact large enough to cause a global catastrophe strike Earth's surface?
- a. every million years
  - b. every 50 to 100 million years
  - c. every 30 to 50 million years
  - d. every few hundred years

# Vocabulary and Section Summary A

## A Solar System Is Born

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. nebula

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2. solar nebula

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3. astronomical unit

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### SECTION SUMMARY

Read the following section summary.

- For a nebula to be stable, outward pressure and the inward force of gravity must be balanced.
- The solar system formed out of a vast cloud of dust and gas called the *solar nebula*. The core of the nebula became the sun. Planets formed from material in the rotating disk.
- Energy is produced in the sun's core by the process of nuclear fusion.
- The sun consists of six layers: the core, the radiative zone, the convective zone, the photosphere, the chromosphere, and the corona.
- Distances in the solar system are measured in astronomical units, light-minutes, and light-hours.
- The inner solar system contains the planets closest to the sun. The outer solar system contains the planets farthest from the sun.

# Vocabulary and Section Summary A

## The Inner Planets

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. terrestrial planet

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2. prograde rotation

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3. retrograde rotation

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### SECTION SUMMARY

Read the following section summary.

- The inner planets include Mercury, Venus, Earth, and Mars.
- The inner planets differ from each other and from other bodies in the solar system in size and composition.
- Mercury is the closest planet to the sun. Mercury is small and rocky and revolves around the sun every 88 days.
- Venus is much like Earth, but Venus's atmosphere is much denser than Earth's.
- Earth is the only planet in the solar system known to support life.
- Evidence suggests that Mars had liquid water in the past and that Mars was geologically active in the past.



# Vocabulary and Section Summary A

## The Outer Planets

### VOCABULARY

In your own words, write a definition of the following term in the space provided.

1. gas giant

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### SECTION SUMMARY

Read the following section summary.

- Jupiter is the largest and most massive planet in the solar system.
- Saturn is the second-largest planet and the least dense planet in the solar system. The rings of Saturn are made of particles of water ice and dust.
- Uranus's axis of rotation is tilted  $98^\circ$ .
- The weather on Neptune includes storms and winds that travel at more than 1,000 km/h.
- Pluto is a dwarf planet. Its moon, Charon, is more than half Pluto's size.
- Hundreds of objects have been discovered in our solar system beyond Neptune's orbit.

# Vocabulary and Section Summary A

## Moons

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. satellite

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2. phase

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3. eclipse

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### SECTION SUMMARY

Read the following section summary.

- Scientists think that Earth’s moon formed from debris that was ejected into space after a large body collided with Earth.
- Moons appear to shine because they reflect the light of the sun.
- As the moon revolves around Earth, the amount of sunlight on the side of the moon that faces Earth changes. Changes in the appearance of the moon are called *phases*.
- An eclipse occurs when the shadow of one celestial body falls on another.
- Mercury and Venus have no moons. Earth has one moon. Mars has two moons.
- Jupiter has more than 60 moons. The largest four are called the *Galilean moons*.
- Saturn has more than 50 moons. The largest, Titan, has an atmosphere that is 700 km thick.
- Uranus and Neptune each have several moons.
- Pluto has only one confirmed moon, Charon. One side of Pluto always faces its moon.

# Vocabulary and Section Summary A

## Small Bodies in the Solar System

### VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. comet

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2. asteroid

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3. meteoroid

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4. meteor

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5. meteorite

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### SECTION SUMMARY

Read the following section summary.

- Comets are small bodies of ice, rock, and cosmic dust that follow elliptical orbits around the sun. Comets originate in the Oort cloud and the Kuiper belt.
- Asteroids are small, rocky objects that are located in a band between Mars and Jupiter. Asteroids have nearly circular orbits around the sun.
- Near-Earth asteroids have wide, elliptical orbits that bring them close to Earth.
- Meteoroids are dust and debris from asteroids and comets.
- Meteoroids that burn up in Earth's atmosphere are meteors. Bodies that reach Earth are called *meteorites*.