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# CK-12 Physical Science For Middle School Quizzes and Tests

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Jean Brainard, Ph.D.

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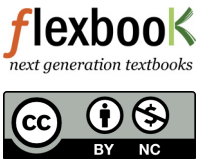





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CHAPTER 1

# The World of Science Assessments

## Chapter Outline



# 1.1 What Is Science?

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. An example of a scientific theory is the idea that
   a. all objects attract each other.
   b. gravity is a dent in the fabric of space and time.
   c. radium is a radioactive element.
   d. what goes up always comes back down.
2. Galileo found evidence to support Copernicus' idea that
   a. objects with greater mass have a greater force of attraction.
   b. the sun is the center of the solar system.
   c. some elements are radioactive.
   d. the sun revolves around Earth.
3. People began to study astronomy as early as
   a. 3500 BC.
   b. 350 BC.
   c. 400 AD.
   d. 1000 AD.
4. Which choice best describes the role of laws in science?
   a. explaining observations
   b. summarizing observations
   c. proving theories
   d. providing rules for research
5. The first step in the evolution of science occurred when someone proposed that
   a. all matter consists of atoms.
   b. particles of matter are constantly moving.
   c. natural events have natural causes.
   d. Earth has gravity.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Modern Western science began during the Scientific Revolution.

_____ 7. Marie Curie was awarded a Nobel prize for her discovery of the structure of the nucleus of the atom.

_____ 8. The man known as the "father of science" used experiments to test competing theories about light.

_____ 9. Science sometimes advances in big leaps.

_____ 10. Theories are unproven laws.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Science is a way of learning about the natural world that is based on evidence and _____.

12. Drawing general conclusions from many individual observations is known as _____.

13. A scientific _____ is a broad explanation that is widely accepted because it is supported by a great deal of evidence.

14. The idea that truth about the natural world can be learned through observation and induction is called _____-___.

15. Science withered in Europe during the period known as the _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Describe how science generally advances.

17. Use an example to show how induction is used in science.

## Answer Key

1. b 2. b 3. a 4. b 5. c

6. true 7. false 8. false 9. true 10. false

11. logic 12. induction 13. theory 14. empiricism 15. Dark Ages

16. Science generally advances as new evidence is used to improve earlier ideas rather than entirely replace them.

17. Answers may vary. *Sample answer:* I observe repeatedly that the sun rises in the East and never in any other location, so I conclude that the sun always rises in the East.

# 1.2 The Scope of Physical Science

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Electricity is
    a. a type of matter.
    b. a form of energy.
    c. a force of nature.
    d. none of the above.
2. Which statement best describes how energy is related to matter?
    a. Energy consists of matter.
    b. Energy allows matter to move.
    c. Energy forms atoms of matter.
    d. Energy is not related to matter.
3. You might learn how lenses correct vision problems if you study
    a. chemistry.
    b. geology.
    c. mathematics.
    d. physics.
4. Which of the following is not a physical science career?
    a. automotive mechanic
    b. physics teacher
    c. chemical engineer
    d. social worker
5. Physics concepts explain
    a. how a thermostat works.
    b. what happens to the water when a mud puddle dries up.
    c. why foods spoil.
    d. two of the above.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Chemistry focuses on atoms and molecules.

_____ 7. The formation of stalactites is a chemical process.

_____ 8. Water waves involve both matter and energy.

_____ 9. Physical science is unrelated to our daily lives.

_____ 10. A forensic scientist prepares and dispenses medicines.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Physical science is the study of _____ and energy.

12. Important concepts in _____ include the structure, properties, and interactions of matter.

13. A candle burning is an example of a(n) _____ change.

14. All of the "stuff" that exists in the universe is _____.

15. A(n) _____ is a professional who measures and records features on Earth's surface.

**Short Answer**

*Answer the following questions in complete sentences.*

16. What is a practical problem that might be addressed by physical science? How are matter and energy involved in the problem?

17. Compare and contrast chemistry and physics.

## Answer Key

1. b 2. b 3. d 4. d 5. a

6. true 7. true 8. true 9. false 10. false

11. matter 12. chemistry 13. chemical 14. matter 15. surveyor

16. *Sample answer:* A practical problem that might be addressed by physical science is how to make electricity safer to use. Matter is involved in the problem because electricity travels through matter such as wires. Energy is involved in the problem because electricity is a form of energy.

17. Both chemistry and physics are physical sciences that study matter and energy. Chemistry focuses on matter and

energy at the scale of atoms and molecules, whereas physics focuses on matter and energy at all scales—from atoms to outer space.

# 1.3 The World of Science

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Thinking like a scientist means
    a. being observant.
    b. using logic.
    c. being curious.
    d. all of the above.
2. The Scientific Revolution occurred mainly in
    a. South America.
    b. Africa.
    c. Europe.
    d. North America.
3. The man known as the "father of science" is
    a. Aristotle.
    b. Galileo.
    c. Copernicus.
    d. Thales.
4. The idea that we can learn the truth about nature through observations and induction is called
    a. empiricism.
    b. logic.
    c. science.
    d. evidence.
5. Physical science is best defined as the study of
    a. motion and forces.
    b. electricity and light.
    c. chemical reactions.
    d. matter and energy.
6. In which class would you be most likely to mix chemicals and observe how they interact?
    a. physics
    b. life science
    c. geology
    d. chemistry
7. Concepts in physics explain why
    a. some cleaning products are better for clothes than for dishes.

b. musical instruments interact with air and become tarnished.
c. water freezes when it gets very cold.
d. satellites stay in orbit around Earth.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Science is defined as a set of facts.

_____ 9. Science generally advances slowly.

_____ 10. Scientists always draw the same conclusions from the same evidence.

_____ 11. Einstein proposed the first law of gravity.

_____ 12. The first woman to win a Nobel prize in science was Irene Joliot-Curie.

_____ 13. Physical science explains much of what you do in your daily life.

_____ 14. Riding a bike involves both matter and energy.

_____ 15. There are few career choices related to physical science.

_____ 16. Advances in physical science make modern life possible.

_____ 17. Chemistry focuses on matter and energy at all scales, from atoms to outer space.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. A scientific _____ is a description of what always happens under certain conditions in nature.

19. The scientist _____ proposed that the sun is at the center of the solar system.

20. The methods of modern science are based on the ideas of the philosopher _____.

21. All of the "stuff" in the universe makes up _____.

22. Electricity is a form of _____.

23. A candle burning is an example of a(n) _____ change.

24. _____ gives matter the ability to change.

25. Concepts in _____ explain how magnets work.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Describe the scientific revolution and its place in modern Western science.

27. Think like a scientist. Use induction to draw a logical conclusion based on the data in the **Table** 1.1:

**TABLE 1.1: Temperature and Magnet Strength**

| Temperature (degrees Celsius) | Magnet Strength (mass attracted in grams) |
|---|---|
| -22 | 280 |
| -21 | 275 |
| -18 | 270 |
| -15 | 265 |
| -13 | 260 |
| -7 | 245 |
| -4 | 220 |
| -2 | 200 |

28. Explain why physical science might be called the "science of everything."

## Answer Key

1. a 2. c 3. d 4. a 5. d 6. d 7. d

8. false 9. true 10. false 11. false 12. false 13. true 14. true 15. false 16. true 17. false

18. law 19. Copernicus 20. Aristotle 21. matter 22. energy 23. chemical reaction 24. Energy 25. physics

26. The scientific revolution occurred in Europe during the mid-1500s to late 1600s. During that time, many scientific advances were made, such as Copernicus' idea that the sun is at the center of the solar system and Newton's law of gravity. The scientific revolution was the beginning of modern Western science.

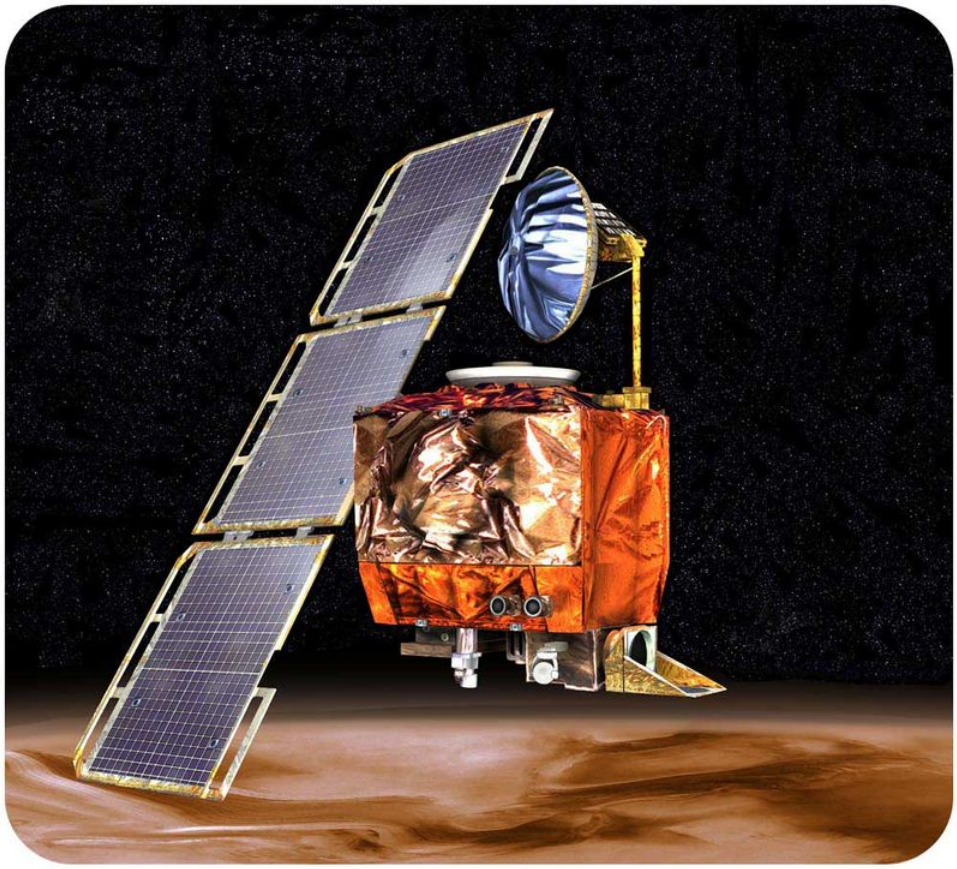
27. *Sample answer:* Based on the data in the table, I conclude a magnet is stronger when it is colder.

28. *Sample answer:* Physical science might be called the "science of everything" because physical science is the study of matter and energy, and everything consists of matter and has energy.

# CHAPTER 2 Scientific Research and Technology Assessments

## Chapter Outline





# 2.1 Scientific Investigation

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The last step in most scientific investigations is
   a. making a model.
   b. analyzing the evidence.
   c. testing the hypothesis.
   d. communicating the results.
2. Which of the following statements does not meet the criteria for a scientific hypothesis?
   a. The moon is made of cheese.
   b. Plants can grow in artificial light.
   c. Copper is attracted by a magnet.
   d. The universe will always exist.
3. Any information that is gathered with the senses is
   a. a fact.
   b. evidence.
   c. an observation.
   d. an investigation.
4. A student did an experiment to test the hypothesis that salt water freezes at a lower temperature than pure water. What is the independent variable in this experiment?
   a. temperature of water
   b. salt content of water
   c. amount of water
   d. freezing point of water
5. Which factor should be a control in the experiment in question 4?
   a. amount of water
   b. amount of salt in water
   c. temperature at which water freezes
   d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. There must be at least two variables in an experiment.

_____ 7. Researchers always communicate their results by writing them up in textbooks.

_____ 8. Evidence gathered in an investigation is useful only if it supports the hypothesis.

_____ 9. Scientists always follow the steps of a scientific investigation in the same sequence.

_____ 10. Scientists do field studies to gather real-world evidence.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A controlled scientific study of a limited number of variables is called a(n) _____.

12. A potential answer to a question that can be tested with evidence is a scientific _____.

13. The dependent variable in an experiment is also called the _____ variable.

14. _____ refers to rules for deciding between right and wrong.

15. A(n) _____ is a variable in an experiment that is held constant so it will not influence the outcome.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Write a prediction based on the following hypothesis.

Hypothesis: A heavier object falls to the ground faster than a lighter object.

17. Devise a scientific investigation to test the hypothesis in question 16. Outline the steps of your investigation.

## Answer Key

1. d 2. d 3. c 4. b 5. a

6. true 7. false 8. false 9. false 10. true

11. experiment 12. hypothesis 13. responding 14. Ethics 15. control

16. *Sample answer:* If I drop a heavy object and a lightweight object from the same height at the same time, then the heavy object will reach the ground first.

17. Answers may vary. *Sample answer:* In my investigation I would drop a heavy ball and a lightweight ball to the ground from the same distance above the ground at exactly the same time. I would have a partner observe which, if either, ball hits the ground first. If the heavy object hits the ground first, my hypothesis would be supported by the evidence.

# 2.2 Science Skills

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. What does SI stand for?
    a. significant figures
    b. scientific notation
    c. international system of units
    d. a scale for measuring temperature
2. The volume of a liquid is best measured with a(n)
    a. metric ruler.
    b. beam balance.
    c. thermometer.
    d. graduated cylinder.
3. How close a measurement is to the true value is its
    a. mean.
    b. range.
    c. precision.
    d. accuracy.
4. An example of a derived quantity is
    a. width.
    b. length.
    c. area.
    d. none of the above.
5. Which unit could be used for volume?
    a. cm
    b. $cm^2$
    c. $cm^3$
    d. $cm^4$

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. There are always more significant figures in the answer than in the numbers used in the calculation.

_____ 7. Only numbers greater than 1 can be written in scientific notation.

_____ 8. The best type of graph to show changes in data over time is a circle graph.

_____ 9. A percent can be expressed as a fraction or a decimal number.

_____ 10. You should never work alone in a science lab.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The kilogram is the basic SI unit for _____.

12. _____ refers to how exact a measurement is.

13. A representation of an object, system, or process is called a(n) _____.

14. A square with each side measuring 5 cm has an area of _____.

15. The mean of 10, 20, 30, 40, and 50 is _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Why are models used in science? What are criteria for a useful model?

17. Argue for the use of the same system of units by all scientists.

## Answer Key

1. c 2. d 3. d 4. c 5. c

6. false 7. false 8. false 9. true 10. true

11. mass 12. precision 13. model 14. 25 $cm^2$ 15. 30

16. Models are used in science as a way to investigate things that are too small, large, complex, or distant to investigate directly. To be useful, a model must closely represent the real thing in important ways, but it must be simpler and easier to manipulate that the real thing.

17. *Sample answer:* All scientists should use the same system of units to avoid mix-ups like the Mars Climate Orbiter disaster. Also, if all scientific investigations use the same units, their results will be easier to compare.

# 2.3 Technology

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Technology refers to
    a. devices such as computers.
    b. processes such as the Bessemer process.
    c. methods such as technological design.
    d. all of the above.
2. The technological design process begins with a(n)
    a. problem.
    b. model.
    c. solution.
    d. test.
3. Which statement is true about the evolution of computers?
    a. It began in 2000.
    b. It is still continuing today.
    c. The first computers used silicon chips.
    d. all of the above
4. How are technology and science related?
    a. Technology and science have the same goal.
    b. Technology and science use the same scientific method.
    c. Technology and science help one another advance.
    d. Technology and science are unrelated.
5. The goal of technology is to
    a. increase scientific knowledge.
    b. set the direction that science takes.
    c. discover new theories.
    d. solve practical problems.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Constraints on technological design include laws of nature.

_____ 7. The risks of a new technological design should outweigh its benefits.

_____ 8. Nanotechnology is used inside the human body.

_____ 9. Technology may be as simple as forks and knives.

_____ 10. Fiber optic technology is used in communications.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ is the application of knowledge to real-world problems.

12. Professionals in technology are generally called _____.

13. The development of new technology is known as technological _____.

14. Technology is sometimes referred to as applied _____.

15. The technology called _____ uses sound waves to map the ocean floor.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Identify factors that are likely to be constraints on most technological designs. Give an example of each.

17. How are technology and society related?

## Answer Key

1. d 2. a 3. b 4. c 5. d

6. true 7. false 8. true 9. true 10. true

11. Technology 12. engineers 13. design 14. science 15. sonar

16. Factors that are likely to be constraints on most technological designs include laws of nature, properties of materials, costs of production, and ethical concerns. Examples of constraints will vary.

17. The goal of technology is to solve society's problems. Therefore, the problems of society generally set the direction that technology takes. Technology, in turn, affects society. For example, it may make people's lives easier or healthier.

# 2.4 Scientific Research and Technology

## Chapter Test

**Name_____ Class_____ Date_____**

*Multiple Choice*

*Circle the letter of the correct choice.*

1. To be useful in science, a hypothesis must be
    a. true.
    b. testable.
    c. replicated.
    d. supported by evidence.
2. Which statement is true about the responding variable in an experiment?
    a. It is the independent variable.
    b. It is manipulated by the researcher.
    c. It must be controlled by the researcher.
    d. none of the above
3. The SI scale for temperature is the
    a. Celsius scale.
    b. Kelvin scale.
    c. Metric scale.
    d. Fahrenheit scale.
4. Which of the following tips should you follow to keep good science records?
    a. Use a loose-leaf notebook.
    b. Record everything in pencil.
    c. Record only the results of experiments.
    d. Date all entries.
5. What is the range of the following set of data: 32, 36, 42, 19, 23, 34, 22, 55?
    a. 23
    b. 29
    c. 36
    d. 74
6. Bar graphs are especially useful for
    a. showing percents of a whole.
    b. comparing values for different types of things.
    c. showing how data change over time.
    d. showing the average of a set of data.
7. How are technology and society related?
    a. Technology attempts to solve people's problems.

b. Technology often makes people's lives easier.
c. Society influences the direction that technology takes.
d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. A scientist never repeats any of the steps of a scientific investigation.

_____ 9. An observation is defined as any information gathered with the eyes.

_____ 10. All scientific investigations involve experiments.

_____ 11. Most scientists use the International System of Units.

_____ 12. To measure the liquid in a graduated cylinder, you should read the top of the meniscus.

_____ 13. Derived quantities are calculated from two or more measurements.

_____ 14. Significant figures is a way of writing very large numbers with exponents.

_____ 15. Models are useful in technology but have no place in science.

_____ 16. You can drink but should not eat in a science lab.

_____ 17. Constraints on technological design may include production costs.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. A(n) _____ is an investigation of a problem in a real-world setting.

19. Another term for the manipulated variable in an experiment is _____ variable.

20. _____ refers to rules for deciding between right and wrong.

21. The basic SI unit for length is the _____.

22. _____ refers to the closeness of a measurement to the true value.

23. Mass is measured with a _____.

24. The temperature 100°C equals _____ on the Kelvin scale.

25. _____ is responsible for most of the major advances in medicine.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Outline the steps generally followed in a scientific investigation.

27. Max and a friend took part in a cross-country bike trip. The trip started at 9:00 AM. The **Table** 2.1 shows how

far they had traveled from the starting point by the end of each hour of the trip until they reached their destination at 1:00 PM. Choose the best type of graph to represent the data, and then make the graph.

**TABLE 2.1: Time and Distance on Bike Trip**

| Time | Distance Traveled from Starting Point (km) |
|---|---|
| 9:00 AM | 0 |
| 10:00 AM | 15 |
| 11:00 AM | 25 |
| 12:00 AM | 35 |
| 1:00 PM | 40 |

28. Describe an example that shows how science and technology work together to help each other advance.

## Answer Key

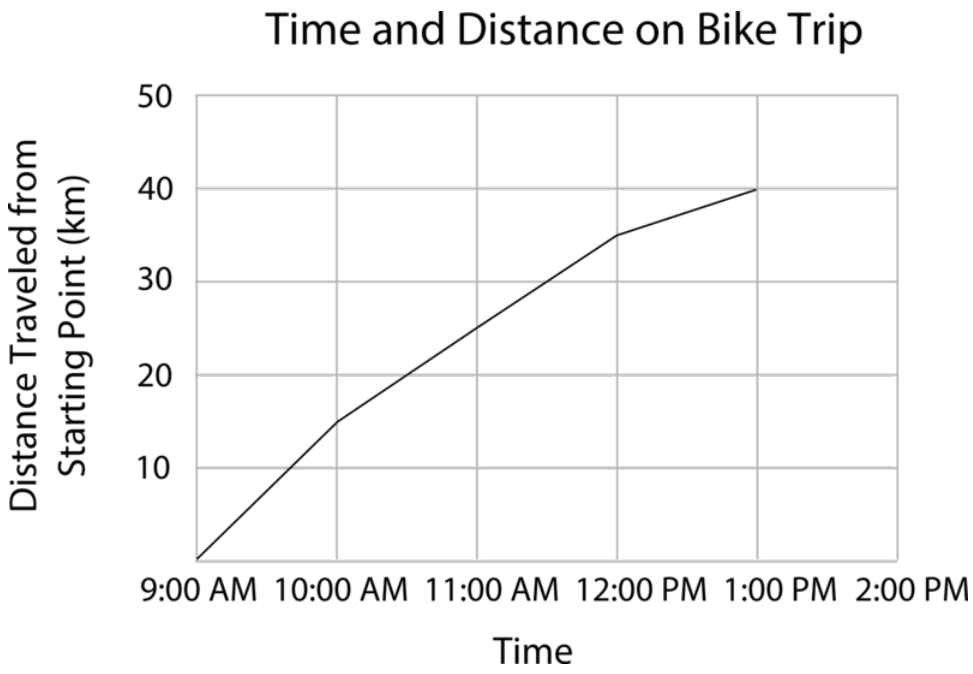
1. b 2. d 3. b 4. d 5. c 6. b 7. d

8. false 9. false 10. false 11. true 12. false 13. true 14. false 15. false 16. false 17. true

18. field study 19. independent 20. Ethics 21. meter 22. Accuracy 23. balance 24. 373 K 25. Technology

26. The steps generally followed in a scientific investigation include: identify a research question or problem, form a hypothesis, gather evidence to test the hypothesis, analyze the evidence, decide whether the evidence supports the hypothesis, draw conclusions, and communicate the results.

27. *Sample graph*:



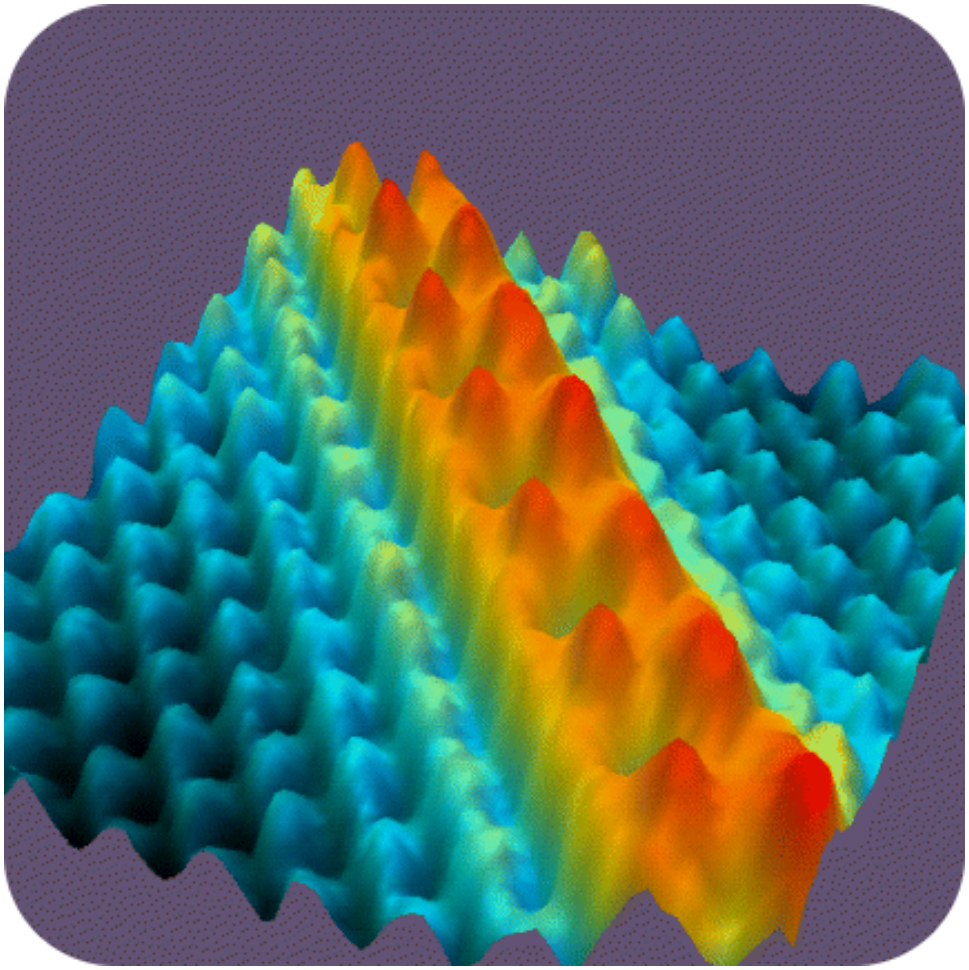

28. Answers may vary. *Sample answer:* An example that shows how science and technology work together to help each other advance is the microscope. In the 1600s, scientific knowledge of light allowed lens makers to make the first microscopes. This new technology, in turn, let scientists view a world of tiny objects they had never before seen.

CHAPTER 3

# Introduction to Matter Assessments

## Chapter Outline





# 3.1 Properties of Matter

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. All of the following are matter except
   a. air.
   b. gas.
   c. sound.
   d. water.
2. The volume of a liquid may be measured with a(n)
   a. scale.
   b. balance.
   c. metric ruler.
   d. graduated cylinder.
3. A physical property of matter is
   a. color.
   b. flammability.
   c. reactivity.
   d. none of the above.
4. Chemical properties of matter include
   a. ability to rust.
   b. odor.
   c. hardness.
   d. all of the above.
5. If an object has a mass of 42 kg and a volume of 2 $m^3$ what is its density?
   a. 84 $kg/m^3$
   b. 44 $kg/m^3$
   c. 21 $kg/m^3$
   d. 0.05 $kg/m^3$

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. The SI unit for liquid volume is the kilogram.

_____ 7. The volume of a liquid depends on the volume of its container.

_____ 8. Physical properties include the ability to conduct heat.

_____ 9. Density is a physical property of matter.

_____ 10. Weight is measured with a scale.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Anything that has mass and takes up space is _____.

12. Matter that can burn has the chemical property of _____.

13. The amount of matter in a substance or object is its _____.

14. The amount of space taken up by matter is its _____.

15. _____ is how closely packed the particles of matter are.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Describe how you could measure the space taken up by a small stone.

17. Explain how an object's weight is related to its mass.

## Answer Key

1. c 2. d 3. a 4. a 5. c

6. false 7. false 8. true 9. true 10. true

11. matter 12. flammability 13. mass 14. volume 15. Density

16. *Sample answer:* To measure the space taken up by a small stone, I would use the displacement method. I would add a given volume of water to a graduated cylinder, put the stone in the water, and then see how much the volume of water had changed. The difference in volume would be the volume of the stone.

17. An object's weight is a measure of the force of gravity pulling on the object. An object with a greater mass is pulled by gravity with greater force, so it will weigh more than an object with a lesser mass (assuming that the force of gravity on both objects is the same).

# 3.2 Types of Matter

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The most common element in Earth's crust is
    a. water.
    b. iron.
    c. hydrogen.
    d. oxygen.
2. The smallest particle of an element that still has the element's properties is a(n)
    a. crystal.
    b. compound.
    c. atom.
    d. molecule.
3. Aristotle thought there were four elements, including
    a. air.
    b. earth.
    c. water.
    d. all of the above.
4. Whenever elements combine physically, they form
    a. mixtures.
    b. solutions.
    c. compounds.
    d. suspensions.
5. Which of the following is the best example of a heterogeneous mixture?
    a. raisin bran
    b. milk
    c. orange juice
    d. water

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Atoms of the same element are all alike.

_____ 7. Each compound has a unique set of properties.

_____ 8. Atoms can be seen with a hand lens.

_____ 9. There are millions of different elements in the universe.

_____ 10. A crystal consists of molecules that are bonded together.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A pure substance that cannot be separated into any other substances is a(n) _____.

12. A(n) _____ is a unique substance that forms when two or more elements combine chemically.

13. A combination of two or more substances in any proportions is a(n) _____.

14. Gelatin is an example of a type of mixture called a(n) _____.

15. A homogeneous mixture in which particles are too small to be seen is a(n) _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Compare and contrast elements and compounds.

17. If you shake together oil and water they temporarily mix. However, after you stop shaking them, the oil eventually floats to the top because it is less dense than water. Explain how you could use this difference in density to separate oil and water.

## Answer Key

1. d 2. c 3. d 4. a 5. a

6. true 7. true 8. false 9. false 10. false

11. element 12. compound 13. mixture 14. colloid 15. solution

16. An element is a pure substance that cannot be separated into any other substances. In contrast, a compound is a substance that forms when two or more elements combine chemically in fixed proportions. Each compound, like each element, has a unique set of properties. Only 92 elements occur naturally, whereas there are millions of different compounds. The smallest particle of an element is an atom. The smallest particle of a compound is a molecule or crystal.

17. *Sample answer:* You could separate oil and water by allowing the oil to rise to the top because of its lesser density. The oil would form a separate layer of liquid above the water. Then you could carefully pour off the oil and stop pouring when you get to the water layer.

# 3.3 Changes in Matter

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which of the following is a physical change?
    a. baking a cake
    b. lighting a match
    c. tying a shoelace
    d. burning a candle
2. After a chemical change has occurred, matter
    a. has less mass than before.
    b. is the same substance as before.
    c. has different chemical properties than before.
    d. all of the above
3. A sign that a chemical change has occurred is a change in
    a. color.
    b. shape.
    c. size.
    d. all of the above.
4. An example of a chemical change is
    a. cutting hair.
    b. washing hair.
    c. bleaching hair.
    d. none of the above.
5. Matter cannot be created or destroyed according to the law of
    a. equal matter.
    b. changes in matter.
    c. conservation of mass.
    d. volume and mass.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Making ice cubes with tap water is an example of a chemical change.

_____ 7. All changes in matter can be reversed.

_____ 8. Melting metal changes it into an entirely different substance.

_____ 9. The release of gas bubbles is a sign of a chemical change.

_____ 10. After a physical change, matter still has the same chemical properties.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A change in which matter becomes an entirely different substances is a(n) _____ change.

12. Tearing paper is an example of a(n) _____ change in matter.

13. Production of an odor is a sign that a(n) _____ change has occurred.

14. A physical change is a change in a(n) _____ property of matter.

15. Iron rusting is an example of a(n) _____ change in matter.

**Short Answer**

*Answer the following questions in complete sentences.*

16. A dog has greater mass as an adult than she did as a puppy. Has matter been created? Why or why not?

17. A puddle on pavement evaporates in the sun. Explain whether this is a chemical or physical change.

## Answer Key

1. c 2. c 3. a 4. c 5. c

6. false 7. false 8. false 9. true 10. true

11. chemical 12. physical 13. chemical 14. physical 15. chemical

16. *Sample answer:* No, matter has not been created. The dog has greater mass as an adult than she did as a puppy because of the all the food, water, and oxygen she took in as she grew up.

17. This is a physical change because the water in the puddle changed to water vapor. Water vapor is the gaseous form of water, so it is still water.

# 3.4 Introduction to Matter

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Examples of matter include
   a. light.
   b. sound.
   c. air.
   d. all of the above.
2. The amount of space matter takes up is its
   a. density.
   b. mass.
   c. weight.
   d. volume.
3. Which of the following is a chemical property of matter?
   a. ability to conduct heat
   b. freezing point
   c. boiling point
   d. reactivity
4. The displacement method could be used to find the
   a. mass of an object.
   b. weight of a gas.
   c. volume of a liquid.
   d. volume of a solid.
5. Which statement is true about any element?
   a. It has a unique set of properties.
   b. It is different from all other elements.
   c. It can be identified on the basis of its properties.
   d. all of the above
6. A unique substance that forms when two or more elements combine chemically is a(n)
   a. mixture.
   b. colloid.
   c. compound.
   d. solution.
7. An example of a chemical change in matter is a(n)
   a. twig breaking.

b. egg frying.
c. ice cube melting.
d. plate cracking.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. The SI unit for mass is the Newton.

_____ 9. A given mass weighs less on the moon than on Earth.

_____ 10. The ability to dissolve in another substance is a chemical property.

_____ 11. Density is the amount of mass in a given volume of matter.

_____ 12. Oxygen is the element that is most common in living things.

_____ 13. Dalton's theory of the atom is basically the same as modern ideas about the atom.

_____ 14. A heterogeneous mixture has the same composition throughout.

_____ 15. The type of mixture with the smallest particles is a suspension.

_____ 16. Physical changes form entirely different substances.

_____ 17. A sign of a chemical change is a change in shape.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. The ability of a substance to combine chemically with other substances is called _____.

19. All _____ has properties of mass and volume.

20. The ability of matter to conduct electricity is a(n) _____ property of matter.

21. A 20-kg object with a volume of 2 m3 has a density of _____.

22. _____ properties of matter can be measured only when matter changes to different substances.

23. The ability of matter to be attracted by a magnet is a(n) _____ property of matter.

24. A change in the size or shape of matter is a _____ change in matter.

25. A log burning is an example of a _____ change in matter.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Compare and contrast physical and chemical properties of matter.

27. Identify types of mixtures, explain how they differ, and give an example of each type.

28. A certain cold remedy is a large tablet that is added to a glass of water. While the tablet dissolves in water, it releases a lot of bubbles. Is a chemical change occurring? How can you tell?

## Answer Key

1. c 2. d 3. d 4. d 5. d 6. c 7. b

8. false 9. true 10. false 11. true 12. false 13. true 14. false 15. false 16. false 17. false

18. reactivity 19. matter 20. physical 21. 10 $kg/m^3$ 22. Chemical 23. physical 24. physical 25. chemical

26. Physical properties of matter are properties that can be measured or observed without matter changing to a different substance. Chemical properties of matter, in contrast, are properties that can be measured or observed only when matter undergoes a chemical change and becomes a different substance. Examples of physical properties include color and hardness. Examples of chemical properties include flammability and reactivity.

27. Mixtures may be heterogeneous or homogeneous. Heterogeneous mixtures vary in their composition. A suspension is a heterogeneous mixture. It has particles that are big enough to reflect light and to settle or filter out of the mixture. An example of a suspension is muddy water. Homogeneous mixtures have the same composition throughout. Colloids and solutions are homogeneous mixtures. A colloid has particles that are big enough to reflect light but too small to settle or filter out. An example of a colloid is gelatin. A solution has particles that are too small or reflect light or to settle or filter out. An example of a solution is salt water.

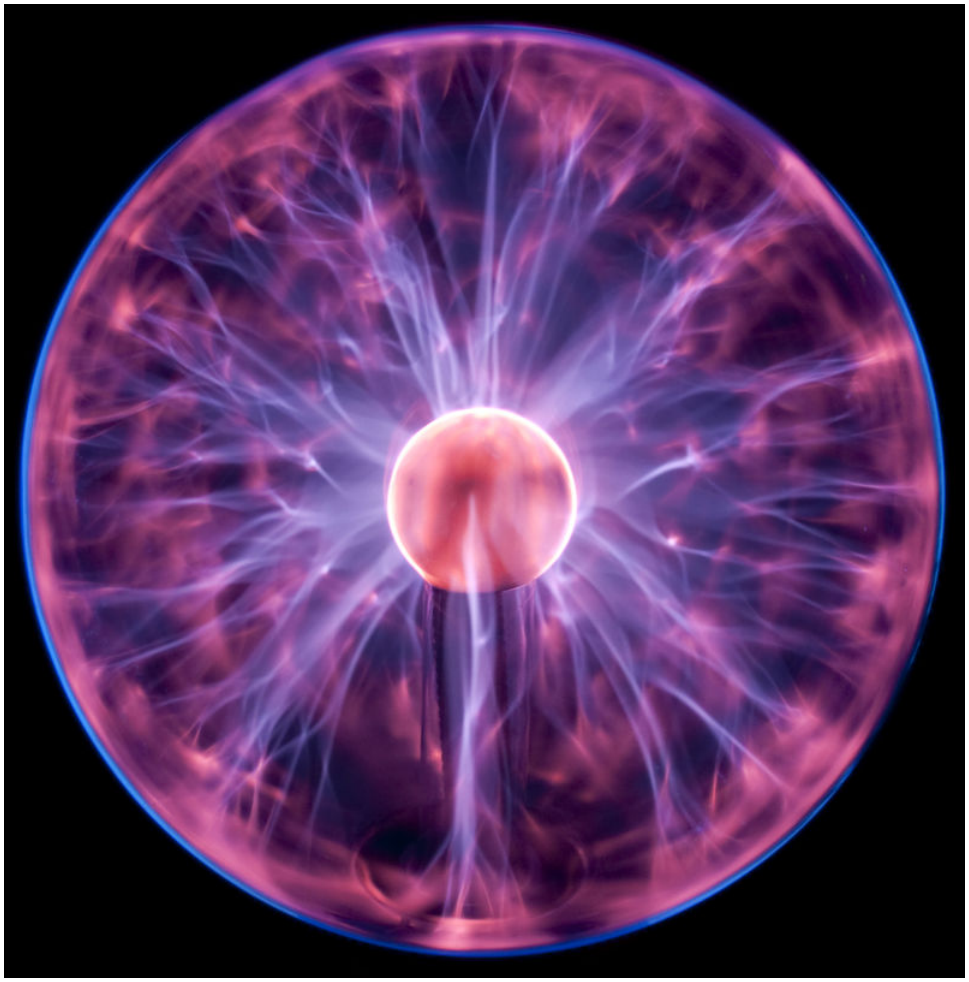
28. A chemical change is occurring. You can tell because the release of gas bubbles is a sign of a chemical change.

CHAPTER 4

# States of Matter Assessments

## Chapter Outline





# 4.1 Solids, Liquids, Gases, and Plasmas

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. In which state does most of the matter in the universe occur?
    a. gas
    b. liquid
    c. solid
    d. plasma
2. Which statement is true about crystalline solids?
    a. Their particles are not arranged in a pattern.
    b. They take the shape of their container.
    c. Their particles have a regular repeating pattern.
    d. Examples include cellulose and candle wax.
3. Honey pours more slowly than vinegar because honey has greater
    a. surface tension.
    b. kinetic energy.
    c. magnetism.
    d. viscosity.
4. Which of the following states of matter takes the volume of its container?
    a. gas
    b. liquid
    c. solid
    d. two of the above
5. Matter in the plasma state
    a. responds to magnetism.
    b. conducts electricity.
    c. glows with light.
    d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Particles with the greatest kinetic energy occur in liquids.

_____ 7. Water forms droplets because of surface tension.

_____ 8. When matter changes state, its chemical properties change.

_____ 9. Table salt is an amorphous solid.

_____ 10. Kinetic energy is energy that moves matter.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Matter with a fixed volume and fixed shape is in the _____ state.

12. _____ is defined as the ability to cause changes in matter.

13. The state of matter that consists of ions is _____.

14. A(n) _____ is matter that has a fixed volume but not a fixed shape.

15. A(n) _____ has neither a fixed volume nor a fixed shape.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Identify and describe the three states of water that exist on Earth.

17. What is the kinetic theory of matter? How is the theory related to states of matter?

## Answer Key

1. d 2. c 3. d 4. a 5. d

6. false 7. true 8. false 9. false 10. true

11. solid 12. Energy 13. plasma 14. liquid 15. gas

16. Three states of matter that exist on Earth are solid, liquid, and gas. Solid water is ice, liquid water is just water, and gaseous water is water vapor. Descriptions of the three states may vary. *Sample answer*: Ice is very cold and hard. Pure liquid water is clear and tasteless. Water vapor is invisible and odorless.

17. The kinetic theory of matter is the theory that all matter consists of constantly moving particles. Particles move at different speeds in different states of matter. They move most quickly in gases, more slowly in liquids, and most slowly in solids.

# 4.2 Behavior of Gases

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The pressure of Earth's atmosphere is
   a. the same everywhere on Earth's surface.
   b. greater at higher altitudes.
   c. 14.7 lb/in$^2$ at sea level.
   d. none of the above
2. The gas laws describe relationships among the gas properties of pressure, temperature, and
   a. mass.
   b. shape.
   c. energy.
   d. volume.
3. If you increase the temperature of a gas in a sealed container, particles of the gas will
   a. have more energy
   b. move more quickly.
   c. exert greater pressure.
   d. all of the above
4. Which law states how the temperature and pressure of a gas are related?
   a. Boyle's law
   b. Charles's law
   c. Amontons's law
   d. Kinetic law
5. To decrease the pressure exerted by a gas, you could
   a. increase its temperature.
   b. increase its volume.
   c. increase its energy.
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. If particles of a gas have room to spread out, they exert greater pressure.

_____ 7. Air pressure is lowest at sea level.

_____ 8. There is an inverse relationship between gas pressure and temperature.

_____ 9. A gas will take up less space if its temperature falls.

_____ 10. As the volume of a gas increases, its pressure decreases.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ is the amount of force pushing against a given area.

12. For gas at a given temperature, decreasing its volume _____ its pressure.

13. The gas law relating temperature and volume is _____ law.

14. If the volume of a gas is held constant, increasing the gas's temperature _____ its pressure.

15. Boyle's law states the relationship between the _____ and pressure of gases.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain why gases exert pressure.

17. Why do the gas laws apply only to gases? Why don't they apply to solids or liquids?

## Answer Key

1. c 2. d 3. d 4. c 5. b

6. false 7. false 8. false 9. true 10. true

11. Pressure 12. increases 13. Charles's 14. increases 15. volume

16. The particles of a gas are constantly moving, so they keep bumping into things. The force of the particles against whatever they bump into creates pressure.

17. *Sample answer:* The gas laws apply only to gases and not to solids or liquids because only gases have freely moving particles that can move to fill all available space and change in volume. The moving particles also bump into things and create pressure. The movement is faster at higher temperatures. These three factors—volume, pressure, and temperature—are related in certain ways that are described by the gas laws.

# 4.3 Changes of State

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. What is the scientific definition of temperature?
    a. average kinetic energy of particles
    b. amount of heat given off by objects
    c. melting and boiling points of substances
    d. none of the above
2. For liquid water to change to water vapor, the water must
    a. lose energy.
    b. gain energy.
    c. boil.
    d. two of the above
3. What happens when you make ice cubes by putting a tray of water in the freezer?
    a. The water gains cold from the freezer.
    b. The particles of water stop moving.
    c. The temperature of the water falls.
    d. The water vaporizes.
4. Fog forms by the process of
    a. evaporation.
    b. freezing.
    c. condensation.
    d. deposition.
5. Snow sublimates to form
    a. ice.
    b. liquid water.
    c. water vapor.
    d. plasma.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Changes of state occur because matter loses or gains energy.

_____ 7. The boiling point of water is 100 °F.

_____ 8. Changes of state are chemical changes in matter.

_____ 9. Water in a mud puddle disappears because it vaporizes.

_____ 10. Freezing changes a liquid to a solid.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ is the process in which a gas changes to a liquid.

12. Water boils and changes to water vapor in the process of _____.

13. A gas changes directly to a solid in the process of _____

14. Snow changes to water vapor without melting when it undergoes _____.

15. _____ is the process in which a liquid changes to a gas without boiling.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Identify and compare the two ways water can change to water vapor. Give an example of each.

17. Explain how the energy of matter changes when it melts.

## Answer Key

1. a 2. b 3. c 4. c 5. c

6. true 7. false 8. false 9. false 10. true

11. Condensation 12. vaporization 13. deposition 14. sublimation 15. Evaporation

16. Two ways that water can change to water vapor are vaporization and evaporation. Vaporization occurs when water boils. Evaporation occurs at lower temperatures without boiling. An example of vaporization is water boiling

in a tea kettle and turning to steam. An example of evaporation is water in a mud puddle slowly turning to water vapor on a hot sunny day.

17. To melt, a solid must gain energy until its temperature reaches the melting point, at which point it changes to a liquid.

# 4.4 States of Matter

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Matter in the plasma state is found in
   a. air.
   b. water.
   c. lightning.
   d. none of the above
2. The theory that all matter consists of constantly moving particles is known as the
   a. physical theory of matter.
   b. attraction theory of matter.
   c. theory of states of matter.
   d. kinetic theory of matter.
3. The state of matter that can change shape but not volume is
   a. gas.
   b. liquid.
   c. solid.
   d. plasma.
4. A gas exerts less pressure when it has a
   a. smaller volume.
   b. lower temperature.
   c. higher temperature.
   d. two of the above
5. The process in which dew drops form is
   a. evaporation.
   b. deposition.
   c. condensation.
   d. melting.
6. Liquid water can change to water vapor by
   a. vaporization.
   b. sublimation.
   c. evaporation.
   d. two of the above
7. Which statement is true about deposition?
   a. It involves a loss of energy.

b. It is the same thing as freezing.
c. It occurs when a solid changes to a gas.
d. It occurs more quickly at higher temperatures.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Particles with the least kinetic energy occur in solids.

_____ 9. Changes of state are chemical changes in matter.

_____ 10. Surface tension is a property of gases.

_____ 11. Cellulose is an example of a crystalline solid.

_____ 12. Charles's law states how the temperature and volume of gases are related.

_____ 13. Increasing the volume of a gas increases its pressure.

_____ 14. Water in a tea kettle changes to steam in the process of evaporation.

_____ 15. Temperature is a measure of the average kinetic energy of particles of matter.

_____ 16. The process that causes icicles to form is melting.

_____ 17. Changes of state involve changes in the kinetic energy of matter.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. The particles of a(n) _____ solid have no definite pattern.

19. A(n) _____ consists of atoms or molecules that spread out to fill their container.

20. The sun and other stars consist of matter in the _____ state.

21. Amontons's law describes the relationship between the temperature and _____ of gases.

22. The law relating the volume and pressure of gases is _____ law.

23. The temperature at which is a solid changes to a liquid is its _____.

24. A solid changes directly to a gas in the process of _____.

25. The boiling point of water is _____ °C.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Compare and contrast matter in the gaseous and plasma states.

27. Describe the relationship between the volume and pressure of a gas at a fixed temperature. What type of relationship is it?

28. When you take a hot shower, the bathroom mirror may "steam up." Explain why this happens.

## Answer Key

1. c 2. d 3. b 4. b 5. c 6. d 7. a

8. true 9. false 10. false 11. true 12. true 13. false 14. false 15. true 16. false 17. true

18. amorphous 19. gas 20. plasma 21. pressure 22. Boyle's 23. melting point 24. sublimation 25. 100

26. Matter in both gaseous and plasma states lacks a fixed volume and a fixed shape. Gases consist of neutral atoms or molecules, whereas plasmas consist of charged ions. This difference allows plasmas, but not gases, to conduct electricity and respond to magnetism.

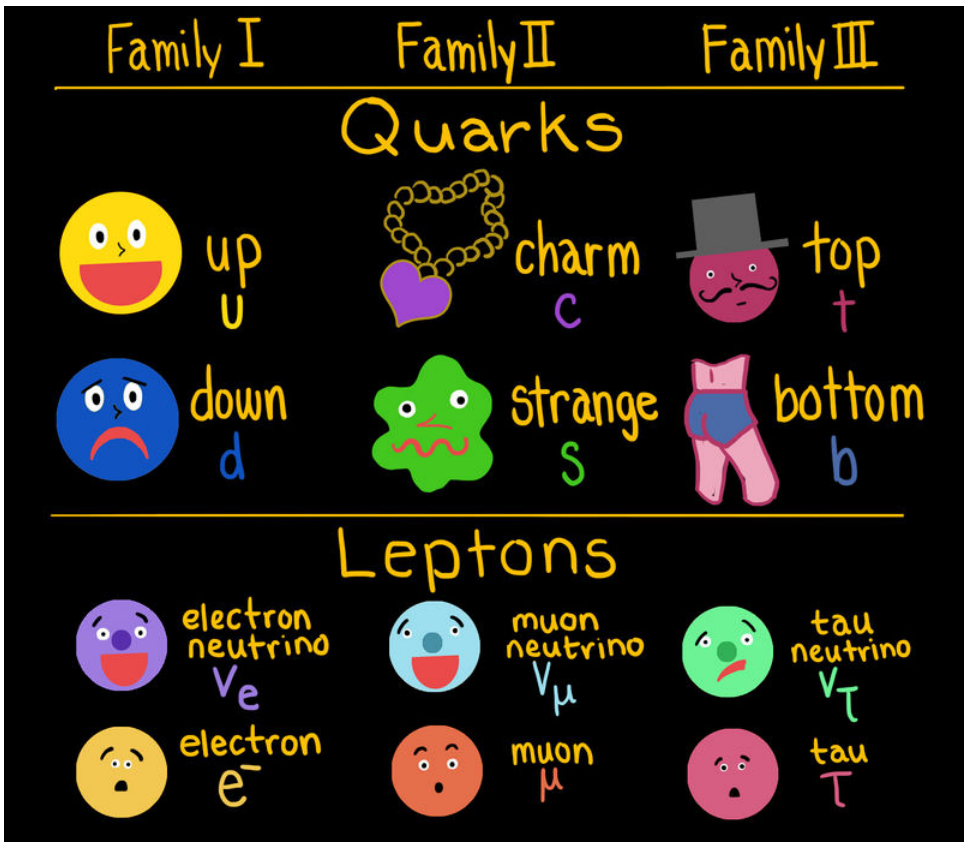
27. For a gas at a fixed temperature, increasing the volume decreases the temperature, and decreasing the volume increases the temperature. This is an inverse relationship, or a relationship between two variables in which a change in one variable is associated with a change in the opposite direction in the other variable.

28. What you take a hot shower, some of the hot water evaporates and turns to water vapor in the air in the bathroom. When the moist air contacts the cool bathroom mirror, the temperature of the air decreases and some of the water vapor condenses on the mirror, causing it to "steam up."

# CHAPTER 5 Atoms Assessments

## Chapter Outline





# 5.1 Inside the Atom

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The smallest particles of an element that still have the element's properties are
    a. quarks.
    b. gluons.
    c. protons.
    d. atoms.
2. Which statement is true about the nucleus of an atom?
    a. It makes up most of the atom's volume.
    b. It makes up most of the atom's mass.
    c. It contains protons and electrons.
    d. It is neutral in electric charge.
3. The strong force explains why
    a. electrons are attracted to the nucleus.
    b. the nucleus does not fly apart.
    c. electrons are smaller than protons.
    d. none of the above
4. The mass number of an atom is its number of
    a. electrons.
    b. protons.
    c. neutrons.
    d. protons plus neutrons.
5. When a fluorine atom gains an electron, it becomes a(n)
    a. positive ion.
    b. isotope.
    c. cation.
    d. anion.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. All protons are exactly the same.

_____ 7. Electrons have the same mass as protons.

_____ 8. Atoms may be positive or negative in charge.

_____ 9. All atoms of a given element have the same number of electrons.

_____ 10. There are three quarks in each neutron.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Neutral particles inside the nucleus of an atom are _____.

12. Protons consist of smaller particles called _____.

13. Negatively charged particles in atoms are _____.

14. An atom with a different number of neutrons than other atoms of the same element is called a(n) _____.

15. The atomic number of an atom is its number of _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. The atomic number of an atom is 10 and its mass number is 21. How many protons, neutrons, and electrons does the atom have? Explain your reasoning.

17. Compare and contrast isotopes and ions.

## Answer Key

1. d 2. b 3. b 4. d 5. d

6. true 7. false 8. false 9. true 10. true

11. neutrons 12. quarks 13. electrons 14. isotope 15. protons

16. The atomic number is the number of protons in an atom, so there are 10 protons in the atom in the question. The mass number is the number of protons plus neutrons, so there are 11 neutrons in the atom. An atom is electrically

neutral, so it always has the same number of electrons are protons. Therefore, the atom has 10 electrons.

17. *Sample answer:* Isotopes are atoms with a different number of neutrons than other atoms of the same elements. They still have the same number of protons and electrons, so they are electrically neutral and have the same properties as other isotopes of the element. Ions form when atoms gain or lose electrons and become electrically charged. They still have the same number of protons and neutrons, but with an electric charge they are no longer atoms and have different properties.

# 5.2 History of the Atom

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which statement is not part of the original atomic theory?
   a. Atoms consist of smaller particles of matter.
   b. Atoms cannot be created or destroyed.
   c. All atoms of the same element have the same mass.
   d. Atoms join together to form compounds.
2. John Dalton thought that an atom is like a(n)
   a. plum pudding.
   b. solar system.
   c. hard solid ball.
   d. vacuum tube.
3. The scientist who discovered protons was
   a. John Dalton.
   b. J. J. Thomson.
   c. Ernest Rutherford.
   d. James Chadwick.
4. Aristotle thought that
   a. atoms exist.
   b. atoms are uncuttable.
   c. all matter consists of atoms.
   d. the idea of atoms is ridiculous.
5. Rutherford concluded from his experiments that
   a. all the positive charge of an atom is concentrated in the center.
   b. positive charge is spread evenly throughout an atom.
   c. electrons orbit the positively charged nucleus.
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Thomson aimed a beam of alpha particles at gold foil.

_____ 7. The plums in the plum pudding model represent protons.

_____ 8. The planets in the planetary model represent electrons.

_____ 9. The first subatomic particle to be discovered was the proton.

_____ 10. Dalton thought that all substances are made of atoms.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The scientist who discovered electrons was _____.

12. The philosopher who first introduced the idea of the atom was _____.

13. The scientist who discovered the nucleus of the atom was _____.

14. The scientist who developed atomic theory was _____.

15. The plum pudding model of the atom was proposed by _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain how electrons were discovered.

17. Create a table to compare and contrast Thomson's and Rutherford's models of the atom.

## Answer Key

1. a 2. c 3. c 4. d 5. d

6. false 7. false 8. true 9. false 10. true

11. Thomson 12. Democritus 13. Rutherford 14. Dalton 15. Thomson

16. Thomson discovered that electric current flows through a vacuum tube from the negative to positive end. This showed that electric current is negative in charge. Thomson also observed that current is attracted to an oppositely charged side plate. This showed that the charge is carried by particles of matter. In summary, Thomson's experiments

showed that an electric current consists of flowing, negatively charged particles. The particles are all alike and smaller than atoms, so Thomson concluded that they must be particles within atoms.

17. *Sample **Table** below:*

{

# 5.3 Modern Atomic Theory

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which statement about energy levels is false?
    a. They are located at fixed distances from the nucleus of the atom.
    b. They are the only places where electrons can be found.
    c. They have more energy when they are farther from the nucleus.
    d. They all have the same number of electrons.
2. What are orbitals?
    a. regions in the electron cloud where electrons are most likely to be
    b. fixed paths in which electrons orbit the nucleus
    c. places where electron waves are unstable
    d. none of the above
3. An electron emits energy when it jumps from
    a. a proton to a neutron.
    b. an electron cloud to an orbital.
    c. an orbital to the atomic nucleus.
    d. a higher energy level to a lower energy level.
4. How many electrons can there be in energy level 1?
    a. 0
    b. 1
    c. 2
    d. 3
5. Bohr's model of the atom differs from Rutherford's model in the
    a. placement of the nucleus.
    b. charge of the nucleus.
    c. number of electrons.
    d. location of electrons.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. The focus of Bohr's research was the nucleus.

_____ 7. Bohr rejected modern atomic theory.

_____ 8. There is a maximum of two energy levels in an atom.

_____ 9. Electrons fall toward the nucleus because they behave like waves.

_____ 10. Energy levels are located between the orbitals of atoms.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The scientist who discovered energy levels was _____.

12. _____ are wavelike particles that move around the nucleus of an atom.

13. The maximum number of electrons per orbital is _____.

14. The number of orbitals at the second energy level is _____.

15. Electrons can change energy levels if they gain or lose _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Make a labeled sketch to illustrate energy levels.

17. Relate orbitals to the electron cloud concept.

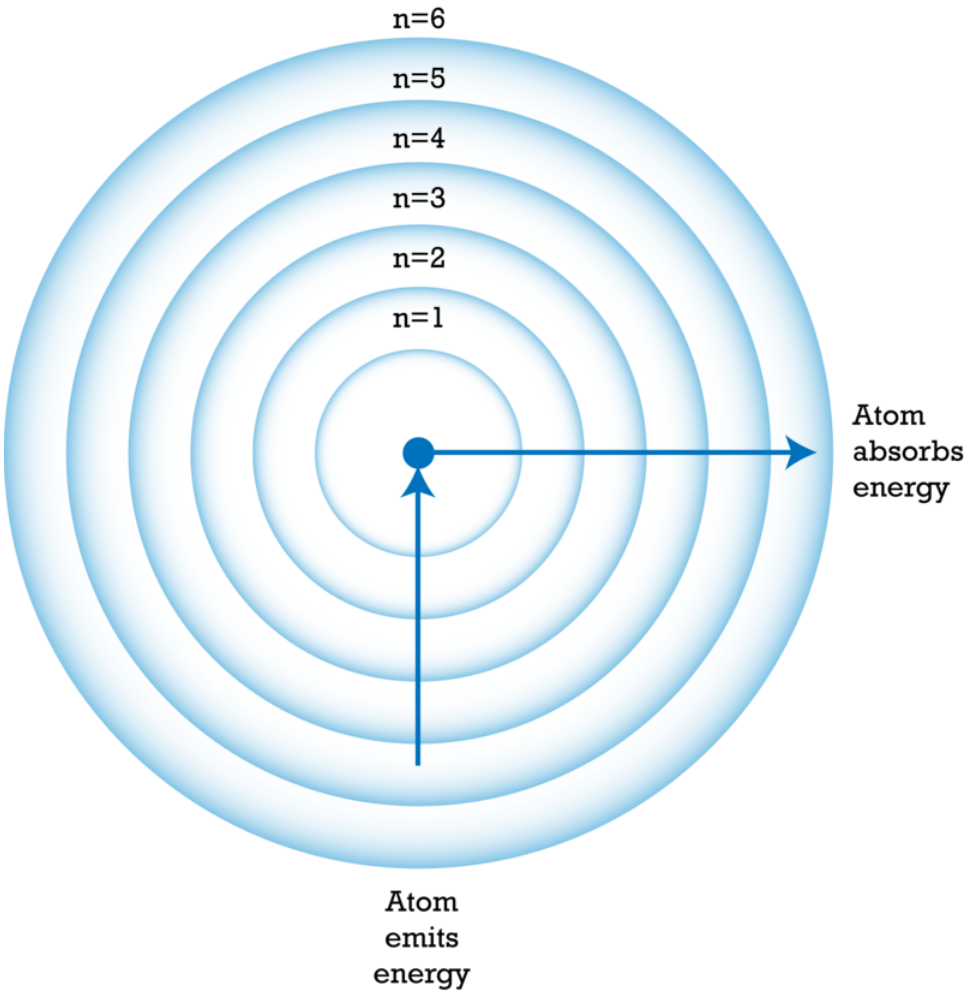
## Answer Key

1. d 2. a 3. d 4. c 5. d

6. false 7. false 8. false 9. false 10. false

11. Bohr 12. Electrons 13. two 14. four 15. energy

16. Sketches may vary but should resemble the **Figure** below.




17. The electron cloud is the area around the nucleus where electrons are likely to be. Some regions of the electron cloud are denser than others. The denser regions are where electrons are most likely to be. They are called orbitals.

# 5.4 Atoms

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which of the following particles of matter are the smallest?
    a. atoms
    b. protons
    c. neutrons
    d. quarks
2. Atoms of a given element all have the same number of
    a. protons.
    b. neutrons.
    c. electrons.
    d. two of the above
3. The strong force is strongest
    a. outside the nucleus.
    b. over very short distances.
    c. when the nucleus is very large.
    d. between protons and electrons.
4. Atomic theory was introduced around
    a. 450 BC.
    b. 1800 AD.
    c. 1900 AD.
    d. 1920 AD.
5. J. J. Thomson discovered the
    a. nucleus.
    b. proton.
    c. neutron.
    d. electron.
6. Rutherford's research involved
    a. electric current and a vacuum tube.
    b. alpha particles and gold foil.
    c. electrons and energy levels.
    d. none of the above
7. Which energy level has the least energy?
    a. 1

b. 2
c. 3
d. 4

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. The SI unit of atomic mass is the gram.

_____ 9. Protons and neutrons have the same mass.

_____ 10. Positive and negative charges in an atom always "cancel out."

_____ 11. An atom with 2 protons and 2 neutrons has an atomic number of 4.

_____ 12. Many isotopes occur naturally

_____ 13. Most of Dalton's atomic theory is still accepted today.

_____ 14. Atoms could not be seen until scanning tunneling microscopes were invented.

_____ 15. Thomson thought that atoms are similar to solid wooden balls.

_____ 16. The first atomic model to add the nucleus was Bohr's model.

_____ 17. An electron emits energy when it jumps to a higher energy level.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. Positively charged particles in an atom are known as _____.

19. An ion with a negative electric charge is called a(n) _____.

20. The strong force holds together protons and _____.

21. Tritium is a(n) _____ of hydrogen.

22. Quarks are held together by _____.

23. Dalton developed a theory of the _____.

24. In Rutherford's experiments, alpha particles were back scattered by _____ of gold atoms.

25. Subatomic particles called _____ have a dual wave and particle nature.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Compare and contrast protons, neutrons, and electrons.

27. What were John Dalton's contributions to knowledge of the atom?

28. Outline how models of the atom changed from Dalton to the present.

## Answer Key

1. d 2. d 3. b 4. a 5. d 6. b 7. a

8. false 9. true 10. true 11. false 12. true 13. true 14. true 15. false 16. false 17. false

18. protons 19. anion 20. neutrons 21. isotope 22. gluons 23. atom 24. nuclei 25. electrons

26. Protons, neutrons, and electrons are all particles within the atom. Protons and neutrons have equal mass and are found together inside the nucleus. Electrons have virtually no mass and are found outside the nucleus. Protons are positive in electric charge, neutrons are neutral in charge, and electrons are negative in charge.

27. John Dalton made major contributions to knowledge of the atom. He revived Democritus's idea of the atom, did experiments that provided evidence for atoms, and developed an atomic theory that is still mostly accepted today.

28. *Sample answer:* Dalton modeled atoms with hard solid balls because he thought they are the smallest particles of matter that cannot be divided into smaller particles. Thomson discovered electrons and modeled atoms with a plum pudding, in which the pudding was a sphere of positive charge and the plums were electrons scattered through it. Rutherford discovered that all the positive charge is concentrated in the center of the atom, so his planetary model has a positive nucleus with electrons orbiting around it. Bohr discovered energy levels, so his model locates the orbiting electrons only at fixed distances away from the nucleus. Today, scientists think electrons are wavelike particles that cannot be located with certainty. They only have a certain chance of being in any given place. They model electrons with orbitals, which are dense regions in the general electron cloud surrounding the nucleus where electrons are most likely to be found.

CHAPTER 6

# Periodic Table Assessments

## Chapter Outline



# 6.1 How Elements Are Organized

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Mendeleev organized the elements based on their
   a. atomic number.
   b. number of protons.
   c. atomic mass.
   d. number of neutrons.
2. In the modern periodic table, atomic number
   a. increases from top to bottom within each period.
   b. increases from left to right within each group.
   c. is the same within each group but not between groups.
   d. none of the above
3. The shortest period in the periodic table is period
   a. 18
   b. 7
   c. 6
   d. 1
4. All but one of the elements on the left side of the periodic table are
   a. metalloids.
   b. liquids.
   c. metals.
   d. gases.
5. Which statement is true about any group in the periodic table?
   a. It includes metals, metalloids, and nonmetals.
   b. It includes elements with similar properties.
   c. It includes gases, liquids, and solids.
   d. It contains 18 different elements.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Mendeleev left spaces in his periodic table for unknown elements.

_____ 7. The modern periodic table is the same as Mendeleev's table but with more elements.

_____ 8. The modern periodic table has more than 100 elements.

_____ 9. Elements called actinides are in period 7 of the periodic table.

_____ 10. Elements in the same period of the periodic table have similar properties.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A row in the periodic table of the elements is called a(n) _____.

12. A column in the periodic table of the elements is called a(n) _____.

13. The classes of elements in the periodic table are metals, nonmetals, and _____.

14. Cr is the _____ for the element chromium.

15. All the elements in group 18 of the periodic table are in the class _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. For two elements in the same group of the periodic table, what is one way they are the same and one way they are different?

17. For most periods of the periodic table, how do elements change from left to right across the period?

## Answer Key

1. c 2. d 3. d 4. c 5. b

6. true 7. false 8. true 9. true 10. false

11. period 12. group 13. metalloids 14. chemical symbol 15. nonmetals

16. *Sample answer:* One way they are the same is that they have the same number of valence electrons. One way they are different is that they have different numbers of protons.

17. For most periods, from left to right, elements change from metals to metalloids to nonmetals.

# 6.2 Classes of Elements

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Most metals are
   a. dull.
   b. brittle.
   c. ductile.
   d. all of the above
2. A nonmetal is an element that
   a. exists only as a gas or liquid.
   b. is completely unreactive.
   c. cannot conduct electricity.
   d. is shiny and malleable.
3. Which of the following elements is a metal?
   a. phosphorus
   b. selenium
   c. lithium
   d. boron
4. Which statement about valence electrons is true?
   a. They are located in the outer energy level of an atom.
   b. They are potentially involved in chemical reactions.
   c. They determine whether an element can conduct electricity.
   d. all of the above
5. If an element is malleable, this means that it can
   a. be formed into long thin shapes like wires.
   b. be formed into thin sheets without breaking.
   c. be used to conduct electric current.
   d. be used as an electric insulator.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. All metalloids are solids are room temperature.

_____ 7. Nonmetals are the second largest class of elements.

_____ 8. Elements with eight valence electron are unreactive.

_____ 9. Fluorine is an example of a metalloid.

_____ 10. Nonmetals tend to give up electrons.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The class of elements that are good conductors of electricity is the _____.

12. The smallest class of elements is the _____.

13. Almost all metals are in the _____ state at room temperature.

14. Carbon and oxygen are elements in the _____ class.

15. Some elements in the _____ class are semiconductors.

**Short Answer**

*Answer the following questions in complete sentences.*

16. A certain element is a gas at room temperature and extremely reactive with other elements. In which class of elements do you think the element should be placed? Why?

17. Explain why metals are used to make objects such as frying pans and electric wires.

## Answer Key

1. c 2. c 3. c 4. d 5. b

6. true 7. true 8. true 9. false 10. false

11. metals 12. metalloids 13. solid 14. nonmetals 15. metalloids

16. *Sample answer:* I think the element should be placed in the nonmetals class. Only nonmetals are gases at room temperature, and some nonmetals are extremely reactive.

17. Metals are used to make objects such as frying pans and electric wires because they are ductile, malleable, and good conductors of heat and electricity.

# 6.3 Groups of Elements

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Hydrogen is in the same group as the alkali metals because
   a. it is a metal.
   b. it is unreactive.
   c. it has one valence electron.
   d. it is in period 1 of the periodic table.
2. Alkaline Earth metals are less reactive than
   a. noble gases.
   b. transition metals.
   c. alkali metals.
   d. all of the above
3. Which groups of the periodic table contain one or more metalloids?
   a. groups 1–2
   b. groups 3–12
   c. groups 13–16
   d. groups 17–18
4. The most reactive nonmetals are elements in the
   a. boron group.
   b. nitrogen group.
   c. oxygen group.
   d. halogen group.
5. All elements in the carbon group
   a. are solids are room temperature.
   b. have four valence electrons.
   c. are not very reactive.
   d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.'*

_____ 6. The most reactive metals are the transition metals.

_____ 7. Alkaline Earth metals have three valence electrons.

_____ 8. Mercury is the only metal that is a liquid at room temperature.

_____ 9. Boron is an example of an element in the metalloids class.

_____ 10. Helium is an element in the group called the halogens.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Most elements with one valence electron are known as _____ metals.

12. Elements in groups 3–12 of the periodic table are called _____ metals.

13. Elements with seven valence electrons are referred to as _____.

14. Elements in group 18 of the periodic table are called _____.

15. The actinide elements are known as _____ metals.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Element X is in group 18 of the periodic table. Based on its position in the periodic table, what can you infer about its properties?

17. Compare and contrast the reactivity of alkali metals and halogens. Explain any similarities and differences.

## Answer Key

1. c 2. c 3. c 4. d 5. d

6. false 7. false 8. true 9. true 10. false

11. alkali 12. transition 13. halogens 14. noble gases 15. transition

16. You can infer that element X is a nonmetal that is gas at room temperature. You can also infer that it has eight valence electrons. This gives it a full outer energy level, so it is unreactive with other elements.

17. Alkali metals and halogens are the most reactive of all elements. Alkali metals are very reactive because they have just one valence electron. They are "eager" to lose their one valence electron and achieve a full outer energy level. Halogens are very reactive because they have seven valence electrons. They are equally "eager" to gain one more valence electron and achieve a full outer energy level.

# 6.4 Periodic Table

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which statement is true about Mendeleev's periodic table?
   a. It was not useful.
   b. It was based on atomic number.
   c. It contained 18 families.
   d. none of the above
2. Which statement is true about the modern periodic table?
   a. Its periods vary in how many elements they contain.
   b. It has more groups than Mendeleev's table.
   c. It includes more than 100 elements represented.
   d. all of the above
3. Within any group of the periodic table, there are elements
   a. in all three states at room temperature.
   b. in all three classes of elements.
   c. with the same number of valence electrons.
   d. with the same number of protons.
4. Which of the following elements is a metalloid?
   a. silicon
   b. silver
   c. sulfur
   d. selenium
5. A certain element is a malleable solid at room temperature. Which of the following elements could it be?
   a. aluminum
   b. boron
   c. carbon
   d. none of the above
6. The only metalloid in the boron group is
   a. boron.
   b. gallium.
   c. indium.
   d. thallium.
7. Which statement about the halogens is false?
   a. They are the elements in group 17.

b. They are the least reactive elements.
c. They have seven valence electrons.
d. They include fluorine and chlorine.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. The modern periodic table is similar to Mendeleev's periodic table.

_____ 9. All chemical symbols have two letters.

_____ 10. Atomic number increases from left to right across the periodic table.

_____ 11. Period 4 is the longest period in the modern periodic table.

_____ 12. Metals are good conductors of heat.

_____ 13. Metalloids are the smallest class of elements.

_____ 14. All nonmetals are gases at room temperature.

_____ 15. Alkali metals are always found in nature combined with other elements.

_____ 16. Transition metals have more valence electrons than alkaline Earth metals.

_____ 17. Noble gases are used in light bulbs because they are very reactive.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. The _____ number of elements is the basis of the modern periodic table.

19. There are a total of _____ groups in the modern periodic table.

20. All the elements in group 2 of the periodic table are in the _____ class of elements.

21. The class of elements that cannot conduct electricity is the _____ class.

22. The only class of elements that are all solids at room temperature is the _____ class.

23. _____ electrons determine how reactive an element is.

24. Elements in group 17 of the periodic table are called the _____.

25. Lithium is an example of a(n) _____ metal.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Describe Mendeleev's periodic table of the elements, and explain why it was a good model.

27. Compare and contrast metals, metalloids, and nonmetals.

28. A certain element reacts explosively with chlorine and forms a salt. In which group does the element most likely belong? Explain your answer.

## Answer Key

1. d 2. d 3. c 4. a 5. a 6. a 7. b

8. true 9. false 10. true 11. false 12. true 13. true 14. false 15. true 16. true 17. false

18. atomic 19. 18 20. metals 21. nonmetals 22. metalloids 23. Valence 24. halogens 25. alkali

26. In Mendeleev's periodic table, elements were organized by increasing atomic mass in repeating rows, or periods, of eight elements each. Elements in the same column, or group, of the table had similar properties. Mendeleev's periodic table was a good model because it allowed him to correctly predict the properties of unknown elements, which were eventually discovered.

27. Metals, metalloids, and nonmetals are the three classes of elements. Metals are elements that can conduct electricity. Most are also shiny, ductile, malleable, and good conductors of heat. Nonmetals are elements that cannot conduct electricity. Solid nonmetals are dull and brittle, and most are poor conductors of heat. Metalloids have some properties of metals and some properties of nonmetals. For example, they may conduct electricity, but only at certain temperatures, and they may be shiny but brittle.

28. The element most likely belongs in the alkali metals group. Alkali metals have just one valence electron, which makes them—along with the halogens—the most reactive of all elements. Chlorine is a halogen, and halogens and alkali metals react violently and form a salt.

CHAPTER 7

# Chemical Bonding Assessments

## Chapter Outline



# 7.1 Introduction to Chemical Bonds

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. There are millions of unique substances in the universe because elements can combine in many different ways to form
   a. mixtures.
   b. solutions.
   c. compounds.
   d. ions.
2. Water is an example of a(n)
   a. unique substance.
   b. chemical compound.
   c. covalent compound.
   d. all of the above
3. Which statement is true about water and hydrogen peroxide?
   a. Both substances have the same properties.
   b. Both substances have the same chemical formula.
   c. Both substances consist of hydrogen and oxygen.
   d. Both substances are mixtures of elements.
4. Chemical bonds always involve
   a. ions.
   b. atoms.
   c. metals.
   d. electrons.
5. The ratio of elements in a given compound
   a. is always 2 to 1.
   b. is always the same.
   c. may vary.
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. An oxygen atom has eight valence electrons.

_____ 7. A molecule of carbon monoxide has two carbon atoms and one oxygen atom.

_____ 8. The types of bonds in chemical compounds determine many of their properties.

_____ 9. The same elements may form different compounds.

_____ 10. The chemical formula for carbon dioxide is $CO_2$.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A(n) _____ is a force of attraction between atoms or ions that share or transfer electrons.

12. A unique substance that forms when elements combine chemically is called a(n) _____.

13. The symbol used to represent a chemical compound is referred to as a(n) _____.

14. The smallest particle of a compound that still has the compound's properties is a(n) _____.

15. $H_2O$ is the chemical formula for _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Describe the role of valence electrons in chemical bonding.

17. How are molecules and atoms related?

## Answer Key

1. c 2. d 3. c 4. d 5. b

6. false 7. false 8. true 9. true 10. true

11. chemical bond 12. chemical compound 13. chemical formula 14. molecule 15. water

16. Valence electrons are the electrons in the outer energy level of an atom. These are the electrons that are transferred or shared in chemical bonding. By sharing or transferring valence electrons, atoms achieve a full outer energy level and a more stable arrangement of electrons.

17. Atoms are the smallest particles of an element that still have the element's properties. Molecules are the smallest particles of a compound that still have the compound's properties. Molecules consist of atoms. For example, when oxygen and hydrogen atoms combine chemically, they form water molecules. Each water molecule consists of two hydrogen atoms and one oxygen atom.

# 7.2 Ionic Bonds

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. When halogens form ions they
   a. become positive in charge.
   b. become negative in charge.
   c. gain two electrons.
   d. two of the above
2. Which two elements would not form ionic bonds?
   a. calcium and lithium
   b. calcium and oxygen
   c. lithium and oxygen
   d. calcium and carbon
3. Energy is released when
   a. valence electrons are removed from an atom.
   b. valence electrons are gained by an atom.
   c. a positive ion forms.
   d. two of the above
4. A sodium ion has a charge of
   a. -1
   b. -2
   c. +1
   d. +2
5. In a given metals group of the periodic table, compared with elements closer to the top of the table, elements closer to the bottom
   a. have valence electrons that are farther from the nucleus.
   b. have valence electrons that are harder to remove from the atom.
   c. need more energy to form positive ions.
   d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. An ionic bond forms when atoms of a nonmetal give up electrons to atoms of a metal.

_____ 7. Sodium and chloride ions have equal but opposite charges.

_____ 8. Metals need energy in order to become ions.

_____ 9. The bonds of crystals are very weak.

_____ 10. Solid ionic compounds are good conductors of electricity.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A charged particle that forms when an atom gains or loses electrons is a(n) _____.

12. The force of attraction that holds together oppositely charged ions is a(n) _____.

13. When positive and negative ions combine chemically, the unique substance that results is a(n) _____.

14. A(n) _____ is a structure that forms when many positive and negative ions bond together.

15. A dissolved ionic compound is called a(n) _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. An unknown compound is an ionic compound. Describe its properties.

17. Why do ionic compounds always include a metal and a nonmetal?

## Answer Key

1. b 2. a 3. b 4. c 5. a

6. false 7. true 8. true 9. false 10. false

11. ion 12. ionic bond 13. ionic compound 14. crystal 15. electrolyte

16. The unknown compound is a unique substance composed of crystals of positive metal ions and negative nonmetal ions. The crystals are strong but rigid, so they are likely to shatter when struck. The compound is a solid at room

temperature because it has a high melting point. It also has a high boiling point. As a solid, it is a poor conductor of electricity. However, as a liquid or when dissolved in water, it is a good conductor of electricity.

17. Ionic compounds consist of positive and negative ions that are held together by ionic bonds. Ionic bonds form when atoms transfer electrons and become oppositely charged ions. Metals have just one or a few valence electrons, which they are "eager" to give up in order to be left with a full outer energy level. This makes them positive ions. Nonmetals have almost enough valence electrons to fill their outer energy level, so they are equally "eager" to gain valence electrons and become negative ions. Thus, the numbers of valence electrons in metals and nonmetals explains why elements in these two classes bond together and form ionic compounds.

# 7.3 Covalent Bonds

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Two hydrogen atoms may bond together to form a hydrogen
   a. ion.
   b. molecule.
   c. compound.
   d. two of the above
2. An example of a covalent compound is
   a. sodium fluoride.
   b. calcium chloride.
   c. carbon dioxide.
   d. all of the above
3. In all covalent bonds, valence electrons are
   a. lost.
   b. gained.
   c. shared equally.
   d. shared.
4. The compound that contains two oxygen atoms and one nitrogen atom is named
   a. oxygen nitride.
   b. dioxygen nitride.
   c. nitrogen dioxide.
   d. nitrogen monoxide.
5. What is the chemical formula for the compound in question 4?
   a. $O_2N$
   b. $N_2O$
   c. NO
   d. $NO_2$

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Covalent bonds form only between atoms of different elements.

_____ 7. A single covalent bond involves just one valence electron.

_____ 8. Sharing electrons allows atoms to have a full outer energy level.

_____ 9. Each hydrogen atom can form two covalent bonds.

_____ 10. The hydrogen end of a water molecule is slightly negative in charge.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The force of attraction that holds together atoms that share electrons is a(n) _____ bond.

12. A(n) _____ bond is a weak bond that forms between oppositely charged ends of nearby molecules.

13. A covalent bond in which one atom has a stronger attraction for the valence electrons is called a(n) _____-_ bond.

14. A covalent compound in which molecules have oppositely charged ends is called a(n) _____ compound.

15. Any compound consisting of two or more nonmetals is a(n) _____ compound.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain why covalent compounds have lower melting points than ionic compounds.

17. How is the boiling point of water related to the polarity of water molecules?

## Answer Key

1. b 2. c 3. d 4. c 5. d

6. false 7. false 8. true 9. false 10. false

11. covalent 12. hydrogen 13. polar 14. polar 15. covalent

16. Ionic compounds exist as crystals of many ions. An ionic crystal is strong and rigid, so it takes a lot of energy to separate the ions and change state to a liquid. This gives ionic compounds high melting points. Covalent compounds,

in contrast, exist as individual molecules. It takes less energy to separate molecules than ions and change state to a liquid. This gives covalent compounds lower melting points than ionic compounds.

17. Water is a covalent compound, so it has a lower boiling point than an ionic compound. However, water is a polar molecule; its oxygen end is slightly negative and its hydrogen end slightly positive. The oppositely charged ends of nearby water molecules attract each other and join the water molecules together by hydrogen bonds. These bonds must be broken for liquid water to change to water vapor. This requires extra energy and gives water a relatively high boiling point for a covalent compound.

# 7.4 Metallic Bonds

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Metallic bonds form because metals
   a. "want" to give up valence electrons.
   b. always share valence electrons.
   c. have many valence electrons.
   d. always gain valence electrons.
2. In metallic bonds, the force of attraction is between
   a. positive and negative ions.
   b. ions and electrons.
   c. two different metals.
   d. neutrons and electrons.
3. Metals are used to make electric wires because metals
   a. are ductile.
   b. are malleable.
   c. have freely moving electrons.
   d. two of the above
4. How does a metallic lattice differ from an ionic crystal?
   a. A metallic lattice is less flexible.
   b. A metallic lattice can change shape without breaking.
   c. A metallic lattice shatters when struck.
   d. all of the above
5. An alloy of iron and carbon is
   a. more likely to rust than pure iron.
   b. weaker than pure iron.
   c. a mixture of two metals.
   d. known as steel.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. A metallic bond may form between a metal and any other element.

_____ 7. Metals can be shaped into thin sheets.

_____ 8. Metal ions are surrounded by a "sea" of positive charge.

_____ 9. Bronze has been used for thousands of years.

_____ 10. Brass is an alloy of iron and copper.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Elements that can conduct electricity are classified as _____.

12. A structure formed by metallic bonding is known as a(n) _____.

13. The force of attraction between a metal ion and surrounding electrons is a(n) _____.

14. A solid solution of a metal with one or more other elements is a(n) _____.

15. A metal ion has a(n) _____ electric charge.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Describe how alloys are made.

17. Explain why metals are good conductors of electricity.

## Answer Key

1. a 2. b 3. d 4. b 5. d

6. false 7. true 8. false 9. true 10. false

11. metals 12. metallic lattice 13. metallic bond 14. alloy 15. positive

16. Alloys are made by melting a metal and dissolving other elements in it. The molten solution is then allowed to cool and harden.

17. Metals are good conductors of electricity because they have freely moving electrons that can carry electric current.

# 7.5 Chemical Bonding

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Chemical bonds form when atoms
   a. gain protons.
   b. combine nuclei.
   c. give up neutrons.
   d. share or transfer electrons.
2. A mystery substance is known to be a chemical compound. What can you infer about the substance?
   a. It is composed of just two elements.
   b. It has a fixed composition.
   c. It consists of molecules.
   d. It forms crystals.
3. Ionic bonds form between
   a. two metals.
   b. two nonmetals.
   c. any two elements.
   d. a metal and a nonmetal.
4. Which of the following is not a property of an ionic compound?
   a. ability to dissolve in water
   b. high boiling point
   c. high melting point
   d. malleability
5. Water is a(n)
   a. chemical compound.
   b. ionic compound.
   c. nonpolar compound.
   d. all of the above
6. All covalent compounds
   a. contain ions.
   b. have high boiling points.
   c. are solids at room temperature.
   d. consist of nonmetallic elements.
7. Which alloy was made first?
   a. steel.

b. brass.
c. bronze.
d. none of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. All chemical bonds involve two atoms sharing electrons.

_____ 9. Chemical compounds are represented by chemical formulas.

_____ 10. The "3" in $NH_3$ is the atomic number of hydrogen.

_____ 11. Positive ions form when atoms lose electrons.

_____ 12. Electrolytes are good conductors of electricity.

_____ 13. Metals release energy when they become ions.

_____ 14. All compounds containing polar bonds are polar compounds.

_____ 15. An example of a covalent compound is carbon dioxide.

_____ 16. Metallic bonds form between metals and nonmetals.

_____ 17. Metallic bonds explain why metals are good conductors of electricity.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. A unique substance that forms when elements combine chemically is a(n) _____.

19. Atoms in compounds are held together by _____.

20. Sodium chloride is an example of a(n) _____ compound.

21. An ionic bond forms when atoms _____ electrons.

22. Bonds that form between two nonmetals are called _____ bonds.

23. Bonds that form between water molecules are called _____ bonds.

24. A(n) _____ is formed by melting a metal and dissolving other elements in it.

25. A metallic lattice consists of positive metal _____ in a "sea" of electrons.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Why does chemical bonding occur?

27. Compare and contrast ionic and covalent bonds.

28. Explain why metals can be shaped without breaking.

## Answer Key

1. d 2. b 3. d 4. d 5. a 6. d 7. c

8. false 9. true 10. false 11. true 12. true 13. false 14. false 15. true 16. false 17. true

18. chemical compound 19. chemical bonds 20. ionic 21. transfer 22. covalent bonds 23. hydrogen bonds 24. alloy 25. ions

26. Chemical bonding occurs because it gives atoms a more stable arrangement of electrons that takes less energy to maintain. When chemical bonding occurs, an atoms shares or transfers electrons for a full outer energy level.

27. Ionic bonds occur when metal atoms transfer electrons to nonmetal atoms, forming oppositely charged ions. The ions bond together in a crystal of many repeating positive and negative ions. Covalent bonds form when two nonmetal atoms share electrons more or less equally. The atoms bond together in individual molecules. These differences in ionic and covalent bonds explain the differences between ionic and covalent compounds.

28. Metals can be shaped without breaking because a metallic lattice is flexible. The lattice is held together by metallic bonding between positive metal ions and a "sea" of surrounding electrons—both their own and those of other ions. The electrons can move freely, allowing the ions to shift positions. This is why the metallic lattice is flexible and will not shatter when struck. The flexibility of the lattice explains why metals are ductile (can be shaped into wires without breaking) and malleable (can be flattened into sheets without breaking).

CHAPTER 8

# Chemical Reactions Assessments

## Chapter Outline



# 8.1 Introduction to Chemical Reactions

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which of the following changes is a chemical change?
   a. ice melting
   b. wax melting
   c. water boiling
   d. wax burning
2. Which statement is true of all chemical reactions?
   a. They can go in just one direction.
   b. They occur only in science labs.
   c. They break and reform bonds.
   d. They create new elements.
3. Reactants and products in chemical reactions may be
   a. elements.
   b. compounds.
   c. exactly the same compounds.
   d. two of the above
4. All chemical changes in matter involve
   a. changes of state.
   b. chemical reactions.
   c. changes in color.
   d. two of the above
5. Which statement is true about a precipitate?
   a. It is a solid.
   b. It settles out of a liquid solution.
   c. It is evidence of a chemical reaction.
   d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. The products and reactants of a chemical reaction have different atoms.

_____ 7. All chemical reactions are reversible.

_____ 8. Rusting is an example of a chemical change.

_____ 9. Condensation is a type of chemical reaction.

_____ 10. A change in temperature is a common sign of a chemical reaction.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The process in which some substances change chemically into others is a(n) _____.

12. In chemical reactions, chemical bonds break in the _____.

13. The substances at the start of a chemical reaction that change to other substances are known as _____.

14. Any substance that is produced in a chemical reaction is called a(n) _____.

15. A chemical reaction has reached _____ when forward and reverse reactions occur at the same rate.

**Short Answer**

*Answer the following questions in complete sentences.*

16. When a certain chemical reaction starts, the amounts of reactants decrease while the amounts of products increase. Soon a point is reached where the amounts of products and reactants stop changing. Can you conclude that the reaction has stopped at this point? Why or why not?

17. Create a sketch to show how hydrogen and oxygen react to form water. Label the reactants and products, and use an arrow to show the direction of the reaction.

## Lesson Quiz Answer Key

1. d 2. c 3. d 4. b 5. d

6. false 7. false 8. true 9. false 10. true

11. chemical reaction 12. reactants 13. reactants 14. product 15. equilibrium

16. No, you can't conclude that the reaction has stopped at this point. The reaction may have reached equilibrium, with forward and reverse directions occurring at the same rate. In that case, the amounts of reactants and products would no longer change.

17. Sketches may vary but should represent the chemical reaction in which two molecules of hydrogen ($2H_2$) and one molecule of oxygen ($O_2$) combine to form two molecules of water ($2H_2O$). Reactants and products should be labeled and there should be an arrow showing the direction of the reaction.

# 8.2 Chemical Equations

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. In chemical equations, reactants and products are represented by
   a. plus signs and arrows.
   b. elements and compounds.
   c. coefficients and subscripts.
   d. chemical symbols and chemical formulas.
2. Which chemical equation is not balanced?
   a. $2Na + Cl_2 \rightarrow 2NaCl$
   b. $C + O_2 \rightarrow CO_2$
   c. $NO + O_2 \rightarrow 2NO_2$
   d. $N_2 + 3H_2 \rightarrow 2NH_3$
3. If there is more than one product in a chemical equation, the products are separated by
   a. plus signs.
   b. minus signs.
   c. equals signs.
   d. two-way arrows.
4. What is the missing coefficient in the following chemical equation? $CH_4 + ?O_2 \rightarrow CO_2 + 2H_2O$
   a. 3
   b. 2
   c. 1
   d. 0
5. Which chemical equation correctly represents the reaction in which carbon combines with oxygen?
   a. $C_2 + O_2 \rightarrow 2CO$
   b. $C_2 + 2O \rightarrow C_2O_2$
   c. $C + O_2 \rightarrow CO_2$
   d. $2C + O \rightarrow C_2O$

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. The symbol $2O_2$ represents two molecules of oxygen.

_____ 7. A coefficient of 1 usually is not written.

_____ 8. Subscripts are used to balance chemical equations.

_____ 9. The first step in balancing a chemical equation is counting atoms.

_____ 10. A chemical equation must balance only when the reaction reversible.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A(n) _____ is a symbolic representation of a chemical reaction.

12. The research of _____ showed that mass is conserved in chemical reactions.

13. Water is the _____ in the chemical reaction $2H_2 + O_2 \rightarrow 2H_2O$

14. A(n) _____ shows the number of atoms or molecules of a substance in a chemical equation.

15. A(n) _____ shows the number of atoms of a substance in a chemical formula.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain how to balance a chemical equation using the following example:

$Hg + O_2 \rightarrow HgO$

17. Why was it important for Lavoisier to carry out his chemical reactions in a sealed container? If the container had not been sealed, could he have shown that matter is conserved? Why or why not?

## Answer Key

1. d 2. c 3. a 4. b 5. c

6. true 7. true 8. false 9. true 10. false

11. chemical equation 12. Lavoisier 13. product 14. coefficient 15. subscript

16. *Sample answer*: The first step in balancing a chemical equation is counting the number of atoms of each type on each side of the arrow. This number must be the same for each type of atom. In the example, there is one mercury (Hg) atom on each side of the arrow, so the equation is balanced for mercury. There are two oxygen atoms ($O_2$) in the reactants but only one oxygen atom in the products, so the equation is not balanced for oxygen. The product must be changed to 2HgO to get the correct number of oxygen atoms on the right side of the equation. Now Hg is no longer balanced, so another mercury atom must be added to the left side of the equation to balance it. The balanced equation is: $2Hg + O_2 \rightarrow 2HgO$.

17. *Sample answer*: It was important for Lavoisier to carry out his chemical reactions in a sealed container so he could capture and find the mass of all of the reactants and products of the reactions. If the container had not been sealed, gaseous reactants and products would escape and could not be measured. Therefore, Lavoisier could not have shown that matter is conserved in chemical reactions. Instead, his results would appear to show that matter was gained or lost in the reactions.

# 8.3 Types of Chemical Reactions

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The general equation for a synthesis reaction is
   a. $AB \rightarrow A + B$
   b. $A + BC \rightarrow B + AC$
   c. $A + B \rightarrow C$
   d. $AB + C \rightarrow A + BC$
2. Which of the following is a decomposition reaction?
   a. $2Na + Cl_2 \rightarrow 2NaCl$
   b. $2H_2O \rightarrow 2H_2 + O_2$
   c. $CH_4 + O_2 \rightarrow CO_2 + H_2O$
   d. $NaCl + AgF \rightarrow NaF + AgCl$
3. Which type of reaction is represented by the following chemical equation? $2K + 2H_2O \rightarrow 2KOH + H_2$
   a. double replacement
   b. single replacement
   c. decomposition
   d. synthesis
4. Which of the following is always a product of a combustion reaction?
   a. water
   b. ashes
   c. smoke
   d. oxygen
5. In living cells, energy is produced by the process called
   a. photosynthesis.
   b. sugar synthesis.
   c. cellular respiration.
   d. glucose decomposition.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. A synthesis reaction occurs when two or more reactants combine to form a single product.

_____ 7. Another term for a combustion reaction is decomposition.

_____ 8. Fossil fuels such as oil and natural gas consist of hydrocarbons.

_____ 9. The fuel that cells use for energy is oxygen.

_____ 10. Plants combine carbon dioxide and water to form glucose.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. In a(n) _____ reaction, one ion takes the place of another in a compound.

12. A(n) _____ reaction occurs when a substance reacts quickly with oxygen.

13. One reactant breaks down into two or more products in a(n) _____ reaction.

14. The opposite of a decomposition reaction is a(n) _____ reaction.

15. During a(n) _____ reaction, ions change places in two compounds.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain what happens when a substance burns.

17. Write the general equation for a double replacement reaction. Explain what each part of the equation represents.

## Answer Key

1. c 2. b 3. b 4. a 5. c

6. true 7. false 8. true 9. false 10. true

11. single replacement 12. combustion 13. decomposition 14. synthesis 15. double replacement

16. When a substance burns, it is the fuel in a combustion reaction. The substance combines quickly with oxygen and forms carbon dioxide and water. Heat and light are usually produced as well.

17. The general equation for a double replacement reaction is AB + CD $\rightarrow$ AD + CB. AB and CD are the reactants, and both are ionic compounds. Compound AB consists of the ions A and B, and compound CD consists of the ions C and D. During the reaction, AB and CD exchange ions B and D, producing two new ionic compounds, AD and CB.

# 8.4 Chemical Reactions and Energy

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. All chemical reactions need energy to
   a. form bonds in products.
   b. break bonds in reactants.
   c. get started.
   d. two of the above
2. Which statement about exothermic reactions is false?
   a. They need activation energy.
   b. They include combustion.
   c. They give off energy.
   d. They take in heat.
3. A constant input of energy is needed in
   a. exothermic reactions.
   b. endothermic reactions.
   c. all chemical reactions.
   d. none of the above
4. You can increase the rate of a chemical reaction by
   a. increasing the temperature of reactants.
   b. decreasing the surface area of reactants.
   c. decreasing the concentration of reactants.
   d. all of the above
5. A catalyst
   a. can catalyze just one chemical reaction.
   b. is always changed in a chemical reaction.
   c. becomes a product in a chemical reaction.
   d. helps reactants come together in a chemical reaction.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. An endothermic chemical reaction is a reaction that releases energy.

_____ 7. The general equation for an exothermic reaction is Reactants + Energy $\rightarrow$ Products.

_____ 8. Plants synthesize glucose in an endothermic chemical reaction.

_____ 9. The law of conservation of energy does not apply to chemical reactions.

_____ 10. Any factor that helps reactants come together lowers the activation energy.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Energy that is stored in the bonds of reactants or products is _____ energy.

12. A(n) _____ is a substance that increases the rate of chemical reactions.

13. The _____ is how fast a chemical reaction occurs.

14. _____ is the number of particles of a substance in a given volume.

15. A(n) _____ chemical reaction absorbs energy.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Outline the role of energy in endothermic chemical reactions.

17. Explain how catalysts work.

## Answer Key

1. d 2. d 3. b 4. a 5. d

6. false 7. false 8. true 9. false 10. true

11. chemical 12. catalyst 13. reaction rate 14. Concentration 15. endothermic

16. Endothermic chemical reactions, like all chemical reactions, need activation energy to get started. Once they begin, endothermic reactions also need a constant input of energy to keep going. That's because the energy released when bonds form in products is less than the energy needed to break bonds in reactants.

17. Catalysts work by lowering the activation energy needed for a reaction to begin. They do this by helping reactants come together so they can react.

# 8.5 Chemical Reactions

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. All of the following involve chemical reactions except
   a. metal rusting.
   b. wood burning.
   c. snow melting.
   d. fruit rotting.
2. Which of the following is evidence of a chemical reaction?
   a. release of gas bubbles
   b. absorption of heat
   c. change in color
   d. all of the above
3. Which of these chemical equations is balanced?
   a. $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
   b. $2Mg + Mn_2O_3 \rightarrow 3MgO + 2Mn$
   c. $CH_4 + O_2 \rightarrow CO_2 + 2H_2O$
   d. $NaCl + BeF_2 \rightarrow 2NaF + BeCl_2$
4. Which atoms are not balanced in this chemical equation? $C_2H_4O_2 + O_2 \rightarrow 2CO_2 + 2H_2O$
   a. carbon (C) atoms
   b. hydrogen (H) atoms
   c. oxygen (O) atoms
   d. two of the above
5. Which type of chemical reaction is represented by this general equation? $A + BC \rightarrow B + AC$
   a. decomposition
   b. replacement
   c. combustion
   d. synthesis
6. Which of these chemicals reaction is not a synthesis reaction?
   a. $2Mg + O_2 \rightarrow 2MgO$
   b. $2P + 3Cl_2 \rightarrow 2PCl_3$
   c. $2HgO \rightarrow 2Hg + O_2$
   d. $N_2 + 3H_2 \rightarrow 2NH_3$
7. Which type of reaction is the answer to question 6?
   a. combustion

b. decomposition
c. single replacement
d. double replacement

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Chemical reactions are necessary for life.

_____ 9. The formation of water from hydrogen and oxygen is a reversible reaction.

_____ 10. A change in state is a common sign of a chemical reaction.

_____ 11. The mass of products always equals the mass of reactants in a chemical reaction.

_____ 12. The same molecules must be present on both sides of a chemical equation.

_____ 13. The reaction $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ is a double replacement reaction.

_____ 14. In a combustion reaction, a fuel combines quickly with oxygen.

_____ 15. Wood burning is an example of an endothermic reaction.

_____ 16. All chemical reactions need energy to get started.

_____ 17. A greater concentration of reactants slows down a chemical reaction.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. Chemical changes occur because of chemical _____.

19. New substances that form in a chemical reaction are called _____.

20. In a balanced chemical equation, the number of _____ of each type must be the same on both sides of the arrow.

21. _____ are changed in a chemical equation in order to balance it.

22. During a(n) _____ reaction, two or more reactants combine to form a single product.

23. The products of a combustion reaction include water and _____.

24. A chemical reaction that absorbs energy is called a(n) _____ reaction.

25. Energy needed to get a chemical reaction started is known as _____ energy.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Write a short paragraph that correctly relates all of the following terms: chemical bond, chemical symbol, chemical formula, chemical reaction, and chemical equation.

27. Explain why a decomposition reaction is the reverse of a synthesis reaction.

28. The products of a certain chemical reaction have a lower temperature than the reactants. Is the reaction endothermic or exothermic? Explain your answer.

## Answer Key

1. c 2. d 3. a 4. c 5. b 6. c 7. b

8. true 9. true 10. false 11. true 12. false 13. false 14. true 15. false 16. true 17. false

18. reactions 19. products 20. atoms 21. Coefficients 22. synthesis 23. carbon dioxide 24. endothermic 25. activation

26. *Sample answer*: In a chemical reaction, chemical bonds are broken in reactants and new chemical bonds are formed in products. A chemical reaction can be is represented by a chemical equation. In a chemical equation, elements are represented by chemical symbols and compounds are represented by chemical formulas.

27. A decomposition reaction is a chemical reaction in which one reactant breaks down to form two or more products. An example of a decomposition reaction is the breakdown of water to form hydrogen and oxygen: $2H_2O \rightarrow 2H_2 + O_2$. This is the opposite of what happens in a synthesis reaction. During a synthesis reaction, two or more reactants combine to form a single product. For example, hydrogen and oxygen combine to form water: 2H2 + O2 $\rightarrow 2H_2O$. Therefore, a decomposition reaction is the reverse of a synthesis reaction.

28. The reaction is endothermic. In an endothermic reaction, not enough energy is released when bonds form in products to break more bonds in reactants. Additional energy is needed to keep the reaction going. This energy is often absorbed as heat. As a result there is a drop in temperature, causing products to have a lower temperature than reactants. The drop in temperature may even be great enough to cause liquid products to freeze.

CHAPTER 9

# Chemistry of Carbon Assessments

## Chapter Outline



# 9.1 Properties of Carbon

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Cellulose is
   a. one of the most common compounds on Earth.
   b. made by the cells of plants and animals.
   c. a monomer of carbon.
   d. all of the above
2. How many bonds can each carbon atom form?
   a. 1
   b. 2
   c. 3
   d. 4
3. The plastic called polythene consists of
   a. repeating monomers of ethene.
   b. only carbon and hydrogen atoms.
   c. many fullerenes joined by covalent bonds.
   d. two of the above
4. Forms of crystalline carbon include
   a. cotton.
   b. graphite.
   c. charcoal.
   d. methane.
5. Which statement about carbon is false?
   a. It has four valence electrons.
   b. It forms covalent bonds with other nonmetals.
   c. It is found in the majority of known compounds.
   d. It rarely forms large compounds called polymers.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Carbon is a nonmetal in group 12 of the periodic table.

_____ 7. A structural formula uses dots to represent electrons.

_____ 8. All carbon polymers are made in labs or factories.

_____ 9. Graphite is used as a lubricant because it is slippery.

_____ 10. Each molecule of methane contains four atoms of carbon.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The form of carbon that is the hardest substance in nature is _____.

12. When monomers bond together with covalent bonds, they form _____.

13. Carbon atoms may bond together to form a hollow sphere called a(n) _____.

14. Pencil "lead" is made of a form of carbon known as _____.

15. Two carbon atoms that share a total of two valence electrons with each other have a(n) _____ covalent bond.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Describe single, double, and triple bonds. Draw a sketch to show how each type of bond is represented in a structural formula.

17. Relate the valence electrons of carbon to its ability to form compounds.

## Answer Key

1. a 2. d 3. d 4. b 5. d

6. false 7. false 8. false 9. true 10. false

11. diamond 12. polymers 13. fullerene 14. graphite 15. single

16. In a single bond, two carbon atoms share one pair of electrons. In a double bond, they share two pairs of electrons, and in a triple bond they share three pairs of electrons. Students should draw structural formulas (real or hypothetical) representing the three types of bonds. Each pair of shared electrons should be represented by a dash.

17. Because it has four valence electrons, carbon needs four more electrons to fill its outer energy level. It achieves this by forming four covalent bonds. Carbon can form bonds with other carbon atoms as well as with the atoms of other elements, and it may form single, double, or triple bonds. Because of carbon's ability to form so many covalent bonds, there are millions of carbon compounds, and more than 90 percent of all known compounds contain carbon.

# 9.2 Hydrocarbons

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which statement about hydrocarbons is false?
    a. All of them are polar compounds.
    b. Most of them are obtained from fossil fuels.
    c. Some of them are solids at room temperature.
    d. They are the simplest type of carbon compounds.
2. The last part of the name of a hydrocarbon compound indicates
    a. the number of bonds between carbon atoms.
    b. the number of carbon atoms per molecule.
    c. the shape of the hydrocarbon compound.
    d. none of the above
3. Hydrocarbons are used in floor wax because they
    a. resist scratches.
    b. tend to repel water.
    c. dissolve well in water.
    d. have high melting points.
4. Which of the following is an example of an unsaturated hydrocarbon?
    a. methene
    b. pentane
    c. propane
    d. ethene
5. Dead organisms in ancient seas gradually formed deposits of
    a. coal.
    b. petroleum.
    c. natural gas.
    d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Hydrocarbons are compounds that contain only carbon and hydrogen.

_____ 7. The simplest hydrocarbons are the aromatic hydrocarbons.

_____ 8. Butane and iso-butane differ in their number of hydrogen atoms.

_____ 9. Alkenes may form straight or branchedchains but not rings.

_____ 10. Hydrocarbons are used to make synthetic fabrics such as polyester.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Saturated hydrocarbons are given the general name of _____.

12. Alkenes and alkynes are classified as _____ hydrocarbons.

13. Molecules with the same chemical formulas but different structural formulas are called _____.

14. Unsaturated cyclic hydrocarbons are known as _____ hydrocarbons.

15. The name of the smallest alkyne is _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Ethane, ethene, and ethyne are hydrocarbons with molecules that contain two carbon atoms each. How do the three molecules differ? What is the chemical formula for each compound?

17. Contrast straight-chain, branched-chain, and cyclic hydrocarbon molecules.

## Answer Key

1. a 2. a 3. b 4. d 5. d

6. true 7. false 8. false 9. false 10. true

11. alkanes 12. unsaturated 13. isomers 14. aromatic 15. ethyne

16. The three molecules differ in the number of bonds between carbon atoms and the number of hydrogen atoms. Ethane has only single bonds, ethene has one double bond, and ethyne has one triple bond. The chemical formula

for methane is $CH_4$. The chemical formula for ethene is $C_2H_4$, and the chemical formula for ethyne is $C_2H_2$.

17. Straight-chain, branched-chain, and cyclic molecules differ in their shape. In straight-chain molecules, all the carbon atoms are lined up in a row, called the backbone of the molecule. In branched-chain molecules, at least one carbon atom branches off to the side from the backbone. In cyclic molecules, the chain of carbon atoms is joined at the two ends to form a ring.

# 9.3 Carbon and Living Things

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Classes of biochemical compounds include all of the following except
    a. lipids.
    b. proteins.
    c. phosphates.
    d. nucleic acids.
2. Living things use lipids for
    a. energy.
    b. enzymes.
    c. cell membranes.
    d. two of the above
3. Functions of proteins include
    a. coding genetic information.
    b. storing energy in animals.
    c. regulating life processes.
    d. making up cell walls.
4. Which statement about RNA is true?
    a. It has a double helix shape.
    b. It consists of two chains of nucleotides.
    c. It is needed for the synthesis of proteins.
    d. It contains the nitrogen base called thymine.
5. A nucleotide consists of a
    a. phosphate group.
    b. nitrogen base.
    c. sugar.
    d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Biochemical compounds are carbon-based compounds found in living things.

_____ 7. The main function of simple carbohydrates is to store energy in animals.

_____ 8. The only biochemical compounds that contains sulfur are nucleic acids.

_____ 9. The most abundant biochemical compound is cellulose.

_____ 10. Hemoglobin transports oxygen through the blood.

*Fill in the Blank'*

*Fill in the blank with the appropriate term.*

11. Complex carbohydrates include starches and _____.

12. Chains of small molecules called _____ make up proteins.

13. Fatty acids that are _____ are found in animal fats.

14. Biochemical compounds that contain nitrogen include nucleic acids and _____.

15. In DNA molecules, the nitrogen base adenine always bonds with _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Compare and contrast saturated and unsaturated fatty acids.

17. Outline the structure and function of starches. What are some good food sources of starches?

## Answer Key

1. c 2. d 3. c 4. c 5. d

6. true 7. false 8. false 9. true 10. true

11. cellulose 12. amino acids 13. saturated 14. proteins 15. thymine

16. Both saturated and unsaturated fatty acids are long carbon chains that make up lipids. Saturated fatty acids have only single bonds between carbon atoms, so the carbons are saturated with hydrogen atoms. Saturated fatty acids are found in fats, which are solid lipids that animals use to store energy. Unsaturated fatty acids have at least one

double bond between carbon atoms, so they are unsaturated with hydrogen atoms. Unsaturated fatty acids are found in oils, which are liquid lipids that plants use to store energy.

17. Starches are complex carbohydrates that consist of hundreds of glucose monomers bonded together. Plants make starches to store extra sugar. Other living things get starches by eating plants. Some good food sources of starches are breads, pastas, cereals, and potatoes.

# 9.4 Biochemical Reactions

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Reactants in cellular respiration include
   a. oxygen.
   b. water.
   c. carbon dioxide.
   d. two of the above
2. The human enzyme named pepsin catalyzes the digestion of
   a. nucleic acids.
   b. fatty acids.
   c. proteins.
   d. sugars.
3. The compound that cells break down to release energy is
   a. chlorophyll.
   b. carbon dioxide.
   c. water.
   d. glucose.
4. Energy for photosynthesis comes from
   a. water.
   b. soil.
   c. light.
   d. chemicals.
5. Which equation correctly represents photosynthesis?
   a. $C_6H_{12}O_6 + 6O_2 + \text{energy} \rightarrow 6CO_2 + 6H_2O$
   b. $6CO_2 + 6O_2 + \text{energy} \rightarrow C_6H_{12}O_6 + 6H_2O$
   c. $C_6H_{12}O_6 + 6CO_2 + \text{energy} \rightarrow 6O_2 + 6H_2O$
   d. $6CO_2 + 6H_2O + \text{energy} \rightarrow C_6H_{12}O_6 + 6O_2$

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. All living things need energy just to stay alive.

_____ 7. Cellular respiration is an endothermic, or energy-absorbing, process.

_____ 8. Only plants can carry out photosynthesis.

_____ 9. Cellular respiration occurs in all living cells

_____ 10. One of the products of cellular respiration is oxygen.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ is the process in which plants and some other organisms make glucose.

12. Catalysts that speed up chemical reactions in living things are called _____.

13. The products of photosynthesis are glucose and _____.

14. Living cells break down glucose for energy in the process of _____.

15. _____ is a green pigment that captures light energy for photosynthesis.

**Short Answer**

*Answer the following questions in complete sentences.*

17. Why do most biochemical reactions require enzymes?

18. Describe how energy changes during photosynthesis and cellular respiration.

## Answer Key

1. a 2. c 3. d 4. c 5. d

6. true 7. false 8. false 9. true 10. false

11. Photosynthesis 12. enzymes 13. oxygen 14. cellular respiration 15. Chlorophyll

16. Most biochemical reactions require enzymes in order to occur quickly enough under normal cell conditions, such as relatively low temperatures.

17. During photosynthesis, energy changes from light energy to chemical energy stored in glucose. During cellular respiration, energy changes from chemical energy in glucose to heat energy and energy stored in many smaller molecules.

# 9.5 Chemistry of Carbon

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which of the following statements about carbon is true?
    a. Carbon is found only in living things.
    b. Plastics are polymers of carbon.
    c. Graphite is a carbon compound.
    d. Carbon forms ionic bonds.
2. All alkenes have
    a. saturated carbon atoms.
    b. at least one double bond.
    c. at least one carbon atom.
    d. the same arrangement of atoms.
3. Which of the following statements about aromatic hydrocarbons is false?
    a. They have a strong scent.
    b. They are shaped like rings.
    c. They have only double bonds.
    d. They contain at least six carbon atoms.
4. Hydrocarbons are used
    a. as fuels.
    b. to make plastics.
    c. to make synthetic fabrics.
    d. all of the above
5. Elements that make up proteins include
    a. sulfur.
    b. calcium.
    c. phosphorus.
    d. two of the above
6. The main function of deoxyribonucleic acid is to
    a. form the walls of cells.
    b. provide energy to cells.
    c. store the genetic code in cells.
    d. speed up chemical reactions of cells.
7. Products of photosynthesis include
    a. water.

b. oxygen.
c. carbon dioxide.
d. chlorophyll.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. A carbon atom has two valence electrons.

_____ 9. Diamond is the hardest natural substance.

_____ 10. Forms of pure carbon include cellulose.

_____ 11. The carbon atoms in ethyne form only single bonds with the hydrogen atoms.

_____ 12. Ethene cannot take a branched-chain shape.

_____ 13. Carbon compounds in living things are called hydrocarbons.

_____ 14. Antibodies are proteins that help defend against infections.

_____ 15. The phosphate groups in nucleic acids encode genetic information.

_____ 16. The products of cellular respiration are the reactants of photosynthesis.

_____ 17. Cellular respiration releases energy in the form of light.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. A crystal of carbon in which each carbon atom is bonded with three others is a(n) _____.

19. Carbon atoms that have double bonds share _____ valence electrons.

20. Both ethene and ethyne are classified as _____ hydrocarbons.

21. Methane has a(n) _____ boiling point than does propane.

22. _____ are biochemical molecules that include sugars, starches, and cellulose.

23. Lipids known as _____ make up the cell membranes of living things.

24. _____ are proteins that increase the rate of biochemical reactions.

25. Reactants in cellular respiration are glucose and _____.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Carbon dioxide consists of one carbon atom and two oxygen atoms. How many bonds does the carbon atom form with each oxygen atom in a molecule of carbon dioxide? Draw the structural formula for carbon dioxide.

27. Protein molecules can take many different complex shapes. How might this be related to the diversity of

functions of proteins?

28. Compare and contrast photosynthesis and cellular respiration.

## Answer Key

1. b 2. b 3. c 4. d 5. a 6. c 7. b

8. false 9. true 10. false 11. true 12. true 13. false 14. true 15. false 16. true 17. false

18. fullerene 19. four 20. unsaturated 21. lower 22. Carbohydrates 23. phospholipids 24. Enzymes 25. oxygen

26. Carbon forms two bonds with each oxygen atom. The structural formula is O=C=O.

27. *Sample answer*: The many different shapes proteins can take might give them a diversity of properties. Proteins with different properties would be able to serve a diversity of functions.

28. *Sample answer*: Both photosynthesis and cellular respiration are extremely important biochemical processes. They are closely related but opposite processes. In photosynthesis, plants and some other organisms use light energy to change carbon dioxide and water to glucose and oxygen. In cellular respiration, living cells change glucose and oxygen to carbon dioxide and water and release energy.

# CHAPTER 10 Chemistry of Solutions Assessments

## Chapter Outline



# 10.1 Introduction to Solutions

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which statement about solvents is true?
    a. They change to the same state as their solutes.
    b. They may be in any state of matter.
    c. They are always in the liquid state.
    d. They cannot be in the solid state.
2. What happens when an ionic solute dissolves?
    a. It becomes negatively charged.
    b. It breaks down into individual atoms.
    c. It forms chemical bonds with the solvent.
    d. It separates into positive and negative ions.
3. Sugar dissolves easily in water because, like water, its molecules have
    a. oppositely charged ends.
    b. a lot of surface area.
    c. ionic bonds.
    d. all of the above
4. Road crews sprinkle salt on an icy road because the salt
    a. prevents snow from falling on the road.
    b. provides better traction than the ice.
    c. lowers the melting point of the ice.
    d. dissolves the ice.
5. Which statement about solutes is false?
    a. They may be in any state of matter.
    b. They make up most of any solution.
    c. They are too small to settle out of a solution.
    d. They are mixed evenly throughout a solution.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Paint thinner dissolves well in water.

_____ 7. Bronze is a solution of copper dissolved in brass.

_____ 8. The solute in carbonated water is a gas.

_____ 9. Stirring a solution interferes with dissolving.

_____ 10. All solutes dissolve more quickly in warmer solvents.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A(n) _____ is a homogeneous mixture of two or more substances.

12. The substance that dissolves in a solution is called the _____.

13. A substance that cannot dissolve in a given solvent is said to be _____.

14. The compound that is known as the universal solvent is _____.

15. A solute generally _____ the boiling point of a solvent

**Short Answer**

*Answer the following questions in complete sentences.*

16. Describe how salt dissolves in water.

17. Explain why antifreeze is added to the water in a car radiator.

## Answer Key

1. b 2. d 3. a 4. c 5. b

6. false 7. false 8. true 9. false 10. false

11. solution 12. solute 13. insoluble 14. water 15. raises (increases)

16. When salt dissolves in water, the negative oxygen ends of water molecules attract the positive sodium ions, and the positive hydrogen ends of water molecules attract the negative chloride ions. These forces of attraction pull the ions apart, and they spread throughout the water as individual ions.

17. Antifreeze is added to the water in a car radiator because the antifreeze raises the boiling point and lowers the freezing point of the water. It prevents the water from boiling in hot weather and freezing in cold weather

# 10.2 Solubility and Concentration

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which statement about solubility is true?
   a. Solubility is the same for all solutes in a given solvent.
   b. Solubility depends on the temperature of the solvent.
   c. Solubility always increases when temperature increases.
   d. two of the above
2. Pressure affects the solubility of
   a. gases.
   b. solids.
   c. liquids.
   d. all of the above
3. Carbon dioxide is least soluble in ocean water
   a. at the equator.
   b. near the South Pole.
   c. in the Arctic Ocean.
   d. in the North Atlantic Ocean.
4. How much solute is there in a 100-gram solution if the concentration is 5 percent?
   a. 5 grams
   b. 20 grams
   c. 95 grams
   d. 100 grams
5. Baking soda has a solubility of 96 gram per liter of 20 °C water. How much baking soda must you add to 2 liters of water at this temperature to make a saturated solution?
   a. 48 grams
   b. 96 grams
   c. 192 grams
   d. 1000 grams

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Epsom salt is more soluble in water than is sugar.

_____ 7. You can increase the solubility of a solute by adding more of it to a solution.

_____ 8. You can dissolve more of a liquid solute if you heat the solution.

_____ 9. Concentration is the amount of solute in a given amount of solvent.

_____ 10. A saturated solution always has a very high concentration.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A dilute solution has a low concentration of _____.

12. Decreasing the pressure on a gas _____ its solubility.

13. _____ is the amount of solute that can dissolve in a given amount of solvent at a given temperature.

14. A(n) _____ solution contains less solute than can dissolve at a given temperature.

15. A solution with a high concentration of solute is called a(n) _____ solution.

**Short Answer**

*Answer the following questions in complete sentences.*

16. The solubility of sodium chloride is 359 g per 1 L of 20 °C water. Describe a saturated and an unsaturated solution of sodium chloride in water.

17. Explain how to calculate the concentration of a solution. Give an example.

## Answer Key

1. b 2. a 3. a 4. a 5. c

6. false 7. false 8. true 9. false 10. false

11. solute 12. decreases 13. Solubility 14. unsaturated 15. concentrated

16. *Sample answer*: An example of a saturated solution of sodium chloride is 359 g per 1 L of 20 °C water. An example of an unsaturated solution of sodium chloride is 358 g per 1 L of 20 °C water.

17. To calculate the concentration of a solution, divide the mass or volume of the solute by the mass of volume of the solution. Concentration is usually expressed as a percent, so the answer is multiplied by 100%. For example, a 100-g saltwater solution that contains 3 g of salt has a concentration of 3 g/100 g $\times$ 100% = 3%.

# 10.3 Acids and Bases

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which of the following substances has a pH greater than 7?
    a. normal (clean) rain
    b. orange juice
    c. bananas
    d. soap
2. Acids produce hydrogen gas when they react with
    a. salts.
    b. bases.
    c. water.
    d. metals.
3. Properties of bases include
    a. a sour taste.
    b. a slippery feel.
    c. the ability to conduct electricity.
    d. two of the above.
4. Which of the following acids is strongest?
    a. sulfuric acid
    b. lemon juice
    c. acid rain
    d. vinegar
5. Products of a neutralization reaction include
    a. hydroxide ions.
    b. hydrogen ions.
    c. water.
    d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Litmus is the only indicator for detecting acids and bases.

_____ 7. Acids have many important uses in industry.

_____ 8. When sodium hydroxide dissolves in water it forms hydrogen ions.

_____ 9. A neutral substance has a pH of 7.

_____ 10. A salt forms when an acid and base react.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A(n) _____ is an ionic compound that produces hydrogen ions when dissolved in water.

12. A(n) _____ turns red litmus paper blue.

13. Acidity is measured on a scale called _____.

14. The reaction of an acid and a base is called a(n) _____ reaction.

15. A bitter taste is a property of ionic compounds known as _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. An unknown substance has a pH of 3. What are some of its properties? How do you know?

17. Explain what determines the strength of an acid or a base.

## Answer Key

1. d 2. d 3. d 4. a 5. c

6. false 7. true 8. false 9. true 10. true

11. acid 12. base 13. pH 14. neutralization 15. bases

16. Properties of the unknown substance include a sour taste, the ability to conduct electricity, and the ability to react with metals and produce hydrogen gas. You know the substance has these properties because, with a pH of 3, the substance is an acid, and these are properties common to acids.

17. The strength of an acid or a base is determined by the concentration of ions (hydrogen ions in the case of an acid, hydroxide ions in the case of a base) that it produces when dissolved in water. The greater the concentration of ions, the stronger the acid or base is.

# 10.4 Chemistry of Solutions

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which of the following substances does not dissolve in water?
   a. antifreeze
   b. acetic acid
   c. paint thinner
   d. two of the above
2. What happens when a sugar crystal dissolves in water?
   a. Water pulls sugar molecules away from the sugar crystal.
   b. Water divides the sugar crystal into separate atoms.
   c. Water weakens bonds inside sugar molecules.
   d. Water separates the sugar molecules into ions.
3. Which properties of the solvent are changed by the solute?
   a. chemical properties
   b. physical properties
   c. atomic properties
   d. nuclear properties
4. You can increase the solubility of salt in water by
   a. increasing the pressure on the water.
   b. stirring the salt into the water.
   c. heating the water.
   d. all of the above
5. The upper limit on how much of a certain solute can dissolve in a given solvent is the solute's
   a. concentration.
   b. saturation.
   c. solubility.
   d. dilution.
6. Which of the following ionic compounds is a base when dissolved in water?
   a. HCl
   b. KCl
   c. NaCl
   d. NaOH
7. Which of the following products contain acids?
   a. laundry detergents

b. concrete blocks
c. lawn fertilizers
d. bath soaps

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Caves form when rocks dissolve in water.

_____ 9. Carbon dioxide is insoluble in water.

_____ 10. Oxygen is the solvent in Earth's atmosphere.

_____ 11. A solute must be in a different state than its solvent.

_____ 12. Solubility is always constant for a given solute.

_____ 13. A concentrated solution contains a relatively high percentage of solute.

_____ 14. You can always dissolve additional solute in a dilute solution.

_____ 15. When hydrogen chloride dissolves in water it forms hydrogen ions.

_____ 16. Drain cleaner is a stronger base than ammonia.

_____ 17. Most organisms need a very low pH.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. A(n) _____ is a substance that dissolves another substance to form a solution.

19. Factors that affect the rate of dissolving include stirring, surface area, and _____.

20. When salt dissolves, it separates into individual _____.

21. For a solid solute, decreasing the temperature _____ its solubility.

22. A(n) _____ solution contains as much solute as will dissolve in it.

23. A(n) _____ solution contains a small percentage of dissolved solute.

24. When an acid reacts with a base, the products include water and a(n) _____.

25. A(n) _____ is an ionic compound that produces hydroxide ions when dissolved in water.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Explain why water is called the universal solvent.

27. Compare and contrast saturated and unsaturated solutions.

28. Define acidity, and explain how it is measured.

## Answer Key

1. c 2. a 3. b 4. c 5. c 6. d 7. c

8. true 9. false 10. false 11. false 12. false 13. true 14. false 15. true 16. true 17. false

18. solvent 19. temperature 20. ions 21. decreases 22. saturated 23. dilute 24. salt 25. base

26. Water is called the universal solvent because so many solutes are soluble in water. Water is such a good solvent because it is a polar compound. This means that water molecules have oppositely charged ends. This makes water good at dissolving both ionic compounds such as salt and polar compounds such as sugar.

27. Whether a solution is saturated or unsaturated depends on the particular solute and its solubility. Each solute has an upper limit on how much of it will dissolve in a given solvent at a given temperature (and pressure in the case of gaseous solutes). A saturated solution contains as much solute as can dissolve in the solvent at a given temperature. An unsaturated solution contains less solute than can dissolve in the solvent at a given temperature.

28. Acidity is defined as the concentration of hydrogen ions in a solution. Acidity is measured on a scale called pH, where pH represents the concentration of hydrogen ions. The higher the concentration of hydrogen ions is, the lower the pH value is; and the lower the concentration of hydrogen ions is, the higher the pH value is. A solution with a pH of 7, which is the pH of pure water, is neutral. A solution with a pH less than 7 is an acid, and a solution with a pH greater than 7 is a base.

CHAPTER 11

# Nuclear Chemistry Assessments

## Chapter Outline



# 11.1 Radioactivity

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The scientist who discovered radioactivity was
    a. Curie.
    b. Geiger.
    c. Becquerel.
    d. none of the above
2. All nuclei that emit radiation are
    a. radioactive.
    b. very large.
    c. unstable.
    d. two of the above
3. The radioactive isotope of carbon is
    a. carbon-12.
    b. carbon-13.
    c. carbon-14.
    d. none of the above
4. Which combination of protons and neutrons would most likely result in a stable nucleus?
    a. 4 protons and 2 neutrons
    b. 4 protons and 4 neutrons
    c. 4 protons and 6 neutrons
    d. 4 protons and 8 neutrons
5. Rocks may release radiation due to
    a. formation of radioactive gas in the rocks.
    b. radioactive elements in the rocks.
    c. carbon-12 in the rocks.
    d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Radon gas is harmful when it burns and causes pollution.

_____ 7. There is no way to detect radiation.

_____ 8. Radioactive isotopes can be used to determine the ages of fossils.

_____ 9. A single large exposure to radiation can burn the skin.

_____ 10. Human activities are responsible for almost all the radiation in the environment.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ is the ability of a nucleus to emit radiation.

12. An isotope that emits charged particles and energy is called a(n) _____.

13. No two elements have the same number of _____.

14. The general term for charged particles and energy emitted by a nucleus is _____.

15. Low-level radiation that occurs naturally in the environment is called _____ radiation.

**Short Answer**

*Answer the following questions in complete sentences.*

16. What makes an isotope radioactive?

17. Explain how radiation can harm living things.

## Answer Key

1. c 2. d 3. c 4. b 5. d

6. false 7. false 8. true 9. true 10. false

11. radioactivity 12. radioisotope 13. protons 14. radiation 15. background

16. An isotope is radioactive if it has an unstable nucleus. A nucleus may be unstable because it has too many protons or an unstable ratio of neutrons to protons.

17. Radiation can harm living things by knocking electrons out of atoms and changing the atoms to ions. Radiation also breaks bonds in DNA and other biochemical compounds. A single large exposure to radiation can burn the skin and cause radiation sickness. Long-term exposure to lower levels of radiation can cause cancer.

# 11.2 Radioactive Decay

## Lesson Quiz

**Name**_____ **Class**_____ **Date**_____

**Multiple Choice**

*Circle the letter of the correct choice.*

1. How does a nucleus change when it undergoes beta decay?
   a. Its atomic number increases.
   b. Its mass number increases.
   c. It has more neutrons.
   d. It has fewer protons.
2. Which of the following nuclear equations represents alpha decay?
   a. ${}^{14}_{6}\mathrm{C} \rightarrow {}^{14}_{7}\mathrm{N} + {}^{0}_{-1}e + \text{Energy}$
   b. ${}^{210}_{84}\mathrm{Po} \rightarrow {}^{210}_{85}\mathrm{At} + {}^{0}_{-1}e + \text{Energy}$
   c. ${}^{238}_{92}\mathrm{U} \rightarrow {}^{234}_{90}\mathrm{Th} + {}^{4}_{2}\mathrm{He} + \text{Energy}$
   d. two of the above
3. For a nuclear equation to be balanced, both sides of the equation must have the same number of
   a. protons.
   b. neutrons.
   c. electrons.
   d. protons plus neutrons.
4. Charged particles are emitted from a nucleus during
   a. beta decay.
   b. alpha decay.
   c. gamma decay.
   d. two of the above
5. Which of the following radioisotopes has the longest half-life?
   a. uranium-238
   b. carbon-14
   c. hydrogen-3
   d. radon-222

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. In all three types of radioactive decay, nuclei emit energy.

_____ 7. During gamma decay, one element changes into another.

_____ 8. Most of Earth's helium formed when alpha particles picked up electrons.

_____ 9. Carbon-14 forms when cosmic rays strike atoms of carbon-12.

_____ 10. Carbon-14 dating can be used to estimate the age of any fossil.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A(n) _____ particle consists of two protons and two neutrons.

12. A(n) _____ particle is represented by the symbol ${}^{0}_{-1}e$.

13. The most penetrating type of radiation is a(n) _____.

14. The rate of decay of radioisotopes in measured in a unit called the _____.

15. _____ is the process in which a radioactive nucleus emits only energy.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Define radioactive decay and explain why it occurs.

17. How are alpha and beta decay similar? How are they different?

## Answer Key

1. a 2. c 3. d 4. d 5. a

6. true 7. false 8. true 9. false 10. false

11. alpha 12. beta 13. gamma ray 14. half-life 15. Gamma decay

16. Radioactive decay is the process in which nuclei of radioisotopes emit charged particles and energy. It occurs because radioactive nuclei are unstable, and they become more stable after they undergo radioactive decay.

17. Both alpha and beta decay are types of radioactive decay in which unstable nuclei emit charged particles and energy, become more stable, and change to different elements. Alpha and beta decay differ in the particles that the nuclei emit. In alpha decay, a nucleus emits two protons and two neutrons (an alpha particle). In beta decay, a neutron changes to a proton and an electron and only then the nucleus emits only the electron (a beta particle). In alpha decay, the element that is produced has two fewer protons than the element that underwent decay. In beta decay, the element that is produced has one more proton than the element that underwent decay.

# 11.3 Nuclear Energy

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which equation represents a nuclear fusion reaction?
   a. ${}^{60}_{27}\text{Co} \rightarrow {}^{60}_{28}\text{Ni} + 1 \text{ Electron} + \text{ Energy}$
   b. ${}^{2}_{1}\text{H} + {}^{3}_{1}\text{H} \rightarrow {}^{4}_{2}\text{He} + 1 \text{ Neutron} + \text{Energy}$
   c. ${}^{238}_{92}\text{U} \rightarrow {}^{234}_{90}\text{Th} + {}^{4}_{2}\text{He} + 1 \text{ Proton} + \text{Energy}$
   d. ${}^{235}_{92}\text{U} + 1 \text{ Neutron} \rightarrow {}^{92}_{36}\text{Kr} + {}^{141}_{56}\text{Ba} + 3 \text{ Neutrons} + \text{Energy}$
2. A nuclear fission reaction occurs when a nucleus absorbs
   a. a proton.
   b. radiation.
   c. a neutron.
   d. light energy.
3. Which of the following is a drawback of using nuclear fission for energy?
   a. It adds carbon to the atmosphere.
   b. It produces radioactive waste.
   c. It releases very little energy.
   d. two of the above
4. If a successful nuclear fusion reactor could be built, the fuel it would use would be
   a. water.
   b. helium.
   c. uranium.
   d. hydrogen.
5. Which statement describes a way that matter and energy are related?
   a. Matter and energy are two forms of the same thing.
   b. Matter can be converted to energy in chemical reactions.
   c. A large amount of matter contains a small amount of energy.
   d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Nuclear fusion is the opposite of nuclear fission.

_____ 7. An atom bomb explosion is an uncontrolled nuclear chain reaction

_____ 8. Waste from nuclear fission is no longer harmful after a couple of years.

_____ 9. In the U.S., most electrical energy is produced in nuclear power plants.

_____ 10. The fuel needed for nuclear fission is very plentiful.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ is the splitting of the nucleus of an atom into two smaller nuclei.

12. In a nuclear power plant, energy from nuclear fission is converted to _____.

13. When two hydrogen nuclei fuse, they form a(n) _____ nucleus.

14. The energy of stars is produced by _____.

15. In the equation $E = mc^2$, the letter $E$ stands for _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Describe a nuclear chain reaction and explain why it occurs.

17. Explain why nuclear fusion is not yet used to produce electricity.

## Answer Key

1. b 2. c 3. b 4. d 5. a

6. true 7. true 8. false 9. false 10. false

11. Nuclear fission 12. electricity 13. helium 14. nuclear fusion 15. energy

16. A nuclear chain reaction is the process in which one nuclear fission reaction leads to others, which lead to others, and so on. Each nuclear fission reaction begins when a nucleus captures a neutron. Then, when the fission

reaction occurs, three neutrons are released. Each of these neutrons can cause other nuclei to fission, explaining why a nuclear chain reaction occurs.

17. Nuclear fusion is not yet used to produce electricity because nuclear fusion can occur only at extremely high temperatures. At such high temperatures, matter can exist only in the plasma state, and there are no known materials that can contain plasma.

# 11.4 Nuclear Chemistry

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The only elements that can naturally change into other elements are
   a. radioactive elements.
   b. metallic elements.
   c. uranium and radium.
   d. gases such as radon.
2. Unstable nuclei may emit
   a. energy.
   b. charged particles.
   c. radiation.
   d. all of the above
3. When a nucleus undergoes gamma decay, it emits
   a. an alpha particle.
   b. a beta particle.
   c. energy.
   d. two of the above
4. In beta decay, an unstable nucleus gains a proton when a(n)
   a. proton divides and becomes two protons.
   b. neutron develops a positive electric charge.
   c. neutron breaks down to a proton and an electron.
   d. electron reverses its charge and becomes a proton.
5. An alpha particle can penetrate
   a. a sheet of paper.
   b. a thin layer of cloth.
   c. a sheet of aluminum.
   d. none of the above
6. What happens when a uranium nucleus absorbs a neutron?
   a. It undergoes nuclear fusion.
   b. It releases three protons.
   c. It splits into two nuclei.
   d. all of the above
7. Which element is used as fuel in nuclear fission power plants?
   a. uranium

b. tritium
c. deuterium
d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Becquerel discovered the Geiger counter.

_____ 9. Very few elements have radioactive isotopes.

_____ 10. Radiation generally cannot be detected directly with the senses.

_____ 11. The half-life of a given radioisotope is always changing.

_____ 12. Carbon-14 forms inside living organisms.

_____ 13. Gamma rays have more energy than do X rays.

_____ 14. Radioactive decay always results in a stable nucleus.

_____ 15. Using nuclear fission for energy causes air pollution.

_____ 16. Nuclear fusion does not occur naturally.

_____ 17. The equation $E = mc^2$ explains why nuclear reactions release so much energy.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. The scientist who discovered the radioactive element radium was _____.

19. Carbon-14 nuclei are unstable because they have too many _____.

20. Radiation weakens metals by removing _____.

21. _____ is a harmful radioactive gas that forms in rocks.

22. The general process in which an unstable nucleus emits radiation is called _____.

23. A(n) _____ particle has the same number of protons and neutrons as a helium atom.

24. The joining of two small nuclei to form a single larger nucleus is called _____.

25. In the equation $E = mc^2$, the letter $m$ stands for _____.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Explain how a Geiger counter works.

27. Describe how a nuclear equation is balanced.

28. Compare and contrast nuclear fission and nuclear fusion reactions.

## Answer Key

1. a 2. d 3. c 4. d 5. d 6. c 7. a

8. false 9. false 10. true 11. false 12. false 13. true 14. false 15. false 16. false 17. true

18. Marie Curie 19. neutrons 20. electrons 21. Radon 22. radioactive decay 23. alpha 24. nuclear fusion 25. mass

26. A Geiger counter is a device that detects radiation. If radiation enters the Geiger counter, it changes atoms of a gas into ions by removing electrons. The ions can carry electric current, and the current causes the Geiger counter to click. The higher the level of radiation is, the more frequently the clicks occur.

27. A nuclear equation is balanced by counting the total number of protons (subscripts) and the total number of protons and neutrons combined (superscripts) on each side of the equation. For the equation to be balanced, these totals must be the same on both sides of the arrow. For example, to balance the alpha decay equation below, there must be 84 protons and 208 protons and neutrons combined on both sides of the equation. Therefore, Pb must have 82 protons (subscript) and 204 protons plus neutrons (superscript).

$$^{208}_{84}\text{Po} \rightarrow {}^{?}_{?}\text{Pb} + {}^{4}_{2}\text{He} + \text{Energy}$$

28. Both nuclear fission and nuclear fusion are types of nuclear reactions that release a great deal of energy. In nuclear fission, an unstable nucleus (such as a uranium nucleus) absorbs a neutron and splits into two smaller nuclei. Three neutrons are also released. Nuclear fusion is the opposite of nuclear fission. In nuclear fusion, two small nuclei (such as hydrogen nuclei) join together to form a single larger nucleus, and one neutron is released.

# CHAPTER 12 Motion Assessments

## Chapter Outline



# 12.1 Distance and Direction

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. If motion is represented by an arrow, what does the head of the arrow show?
   a. speed
   b. position
   c. distance
   d. direction
2. If you were riding in a car down a city street, which frame of reference would not allow you to detect that the car was moving?
   a. the driver of the car
   b. buildings along the street
   c. traffic lights at intersections
   d. cars parked on the sides of the street
3. What SI unit would be most appropriate for measuring the distance between Earth and the moon?
   a. kilometer
   b. meter
   c. yard
   d. mile
4. Which word could be used to describe the direction of a moving object?
   a. far
   b. fast
   c. forever
   d. forward
5. Frame of reference is
   a. something that affects perception of motion.
   b. a way to represent distance and direction.
   c. the line along which something moves.
   d. any change of location.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Short distances may be measured in centimeters.

_____ 7. You can use a map to measure the distance between two points.

_____ 8. You can measure the distance an object travels only if it does not change direction.

_____ 9. Speed is one way to measure motion.

_____ 10. The length of a vector arrow represents direction.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ is defined as a change in position.

12. Motion includes both distance and _____.

13. The SI unit for distance is the _____.

14. Any quantity that includes both size and direction is called a(n) _____.

15. _____ is the length of the route between two points.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain how to use a map to find the straight-line distance between two points.

17. Describe an original example that shows how frame of reference affects the perception of motion.

## Answer Key

1. d 2. a 3. a 4. d 5. a

6. true 7. true 8. false 9. true 10. false

11. Motion 12. direction 13. meter 14. vector 15. Distance

16. To find the distance, you could use a ruler to measure the length of the straight-line distance between the two points. Then, you would convert the ruler measurement to kilometers (or miles), using the scale in the key of the map.

17. *Sample answer*: If you are riding your bike along a fence, you can tell how fast you are moving by using the fence posts as a frame of reference. The faster the fence posts seem to fly by, the greater your speed on the bike.

# 12.2 Speed and Velocity

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Speed depends on how far something travels and
   a. how steep its route is.
   b. which direction it travels.
   c. how much time it takes to travel that far.
   d. none of the above
2. What is the SI unit for speed?
   a. s
   b. m
   c. m/s
   d. s/m
3. If the slope of a distance-time graph is steep, then the speed of the object must be
   a. slow.
   b. rapid.
   c. constant.
   d. changing.
4. If you travel 500 kilometers in 5 hours, your average speed is
   a. 5 km/h
   b. 50 km/h
   c. 100 km/h
   d. 250 km/h
5. Objects moving at the same velocity have the same
   a. size.
   b. speed.
   c. direction.
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Both speed and velocity are vectors.

_____ 7. The symbol $\Delta t$ represents a change in time.

_____ 8. The length of a velocity arrow represents distance.

_____ 9. A straight line on a distance-time graph means that speed is zero.

_____ 10. Speed is negative when an object moves backward.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. How quickly something moves is its _____.

12. _____ is a measure of the speed and direction of motion.

13. Speed is represented by the slope of a(n) _____ graph.

14. Speed at a given moment in time is called _____ speed.

15. Speed multiplied by time yields _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain how two moving objects could have the same speed but different velocities. Use examples in your answer.

17. Assume you are taking a trip with your family and you want to make a distance-time graph for the trip. Describe the data you would need to collect for your graph, how you would collect it, and how you would display it in the graph.

## Answer Key

1. c 2. c 3. b 4. c 5. d

6. false 7. true 8. false 9. false 10. false

11. speed 12. Velocity 13. distance-time 14. instantaneous 15. distance

16. Two moving objects could have the same speed but different velocities if they are moving in different directions. For example, two cars traveling at 100 km/h have the same speed, but their velocities are different if one is traveling north and the other is traveling south.

17. You would need to measure the distance traveled between regular time intervals, such as every 15 minutes or half hour. You could find the distances by recording the car's odometer (mileage indicator) reading at those time intervals and then finding the difference between adjacent readings. To make the graph, you would plot distance on the y-axis of your graph and time on the x-axis. Then you would connect the points with straight lines. The slope of the lines would show your average speed during each interval.

# 12.3 Acceleration

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Acceleration occurs whenever an object
   a. moves.
   b. changes position.
   c. changes direction.
   d. two of the above
2. Which of the following is an example of acceleration?
   a. a top spinning at a constant speed
   b. a car slowing down through an intersection
   c. a train going a steady 80 km/h along a straight track
   d. two of the above
3. What is the acceleration of a bicycle that goes from 3 m/s to 1 m/s in 2 seconds?
   a. 0.5 $m/s^2$
   b. 1.0 $m/s^2$
   c. 1.5 $m/s^2$
   d. -1.0 $m/s^2$
4. If the line of a velocity-time graph slopes upward, then acceleration must be
   a. zero.
   b. positive.
   c. negative.
   d. changing.
5. The x-axis of a velocity-time graph represents
   a. speed.
   b. velocity.
   c. direction.
   d. none of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Acceleration is a vector.

_____ 7. Acceleration shows how quickly velocity changes.

_____ 8. A change in direction without a change in speed is not acceleration.

_____ 9. A velocity-time graph shows how velocity changes over time.

_____ 10. Acceleration is always greater than or equal to zero.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ measures changes in velocity.

12. Deceleration refers to a(n) _____ change in velocity.

13. The SI unit for acceleration is _____.

14. The slope of a(n) _____ graph represents acceleration.

15. If velocity is not changing, then acceleration is _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain how to calculate acceleration when direction does not change. Illustrate your answer with an example.

17. Thomas thinks that acceleration means "speeding up." Explain why this is incorrect.

## Answer Key

1. c 2. d 3. d 4. b 5. d

6. true 7. true 8. false 9. true 10. false

11. Acceleration 12. negative 13. $m/s^2$ 14. velocity-time 15. zero

16. When direction does not change, acceleration is calculated by dividing the change in velocity by the change in time. For example, if an object changes velocity from 2 m/s to 4 m/s in 2 seconds, then it accelerates at a rate of (4 m/s - 2 m/s) ÷ 2 s = 1 $m/s^2$.

17. Acceleration does not mean “speeding up” because acceleration also occurs when an object slows down or when it changes its direction without changing speed.

# 12.4 Motion

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The SI unit for distance is the
   a. acre.
   b. meter.
   c. kilogram.
   d. centiliter.
2. What is the average speed of a boat that travels 57 kilometers in 3 hours?
   a. 171 km/h
   b. 60 km/h
   c. 54 km/h
   d. 19 km/h
3. How far will the boat in question 3 travel if it maintains this speed for 5 hours?
   a. 89 km
   b. 95 km
   c. 114 km
   d. 117 km
4. If you use an arrow to represent velocity, what does the head of the arrow show?
   a. speed
   b. distance
   c. direction
   d. none of the above
5. What does $\Delta v/\Delta t$ represent?
   a. speed
   b. velocity
   c. acceleration
   d. none of the above
6. Which of the following is the best definition of deceleration?
   a. zero acceleration
   b. constant acceleration
   c. changing acceleration
   d. negative acceleration
7. Acceleration always involves a change in
   a. speed.

b. velocity.
c. direction.
d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Very short distances should be measured in kilometers.

_____ 9. Distance is less important than direction in describing motion.

_____ 10. Words that describe direction include back and forth.

_____ 11. Speed is an example of a vector.

_____ 12. A horizontal line on a distance-graph represents a speed of zero.

_____ 13. Distance equals speed divided by time.

_____ 14. If an object's speed changes so does its velocity.

_____ 15. Calculating acceleration is complicated when both speed and direction are changing.

_____ 16. You are accelerating when you jump up and down on a trampoline.

_____ 17. The SI unit for acceleration is km/s$^2$.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. Motion is defined as a change in _____.

19. Motion is a(n) _____ when both distance and direction are included.

20. _____ is something an observer uses to perceive motion.

21. How far you travel in a given amount of time can be used to calculate your _____.

22. The _____ of a distance-time graph represents speed.

23. Meters per second is the SI unit for _____.

24. Any change in velocity is referred to as _____.

25. The slope of a velocity-time graph represents _____.

**Short Answer**

*Answer the following questions in complete sentences.*

26. What are vectors? How are arrows used to represent them? Which measures of motion are vectors?

27. Explain how to calculate average speed. Use an example to illustrate your answer.

28. Explain why acceleration, but not speed, can have a negative value.

## Answer Key

1. b 2. d 3. b 4. c 5. c 6. d 7. b

8. false 9. false 10. true 11. false 12. true 13. false 14. true 15. true 16. true 17. false 18. position 19. vector

20. Frame of reference 21. speed 22. slope 23. speed 24. acceleration 25. acceleration

26. Vectors are measures that include both size and direction. Vectors are represented by arrows. The way an arrow points represents direction, and the length of the arrow represents distance or speed. Velocity and acceleration are measures of motion that are vectors.

27. Average speed is calculated by dividing the distance traveled by the time it takes to travel that distance, or $\Delta d$ (change in distance) $\div$ $\Delta t$ (change in time). For example, if you travel a distance of 50 km and it takes you 2 hours to travel that far, then your average speed is 25 km/h.

28. Speed cannot have a negative value because an object cannot move less than being stationary, in which case its speed is zero. However, acceleration, which is a change in speed (if direction does not change), can be negative. This happens when speed is decreasing.

# CHAPTER 13 Forces Assessments

## Chapter Outline



# 13.1 What is Force?

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. How much an object's motion changes when force is applied to it depends on the strength of the force and the object's
   a. size.
   b. mass.
   c. volume.
   d. velocity.
2. Why is force a vector?
   a. It causes objects to move.
   b. It has size and direction.
   c. It can be measured.
   d. two of the above
3. One newton is defined as the amount of force that causes
   a. a weight of 1 pound to reach a speed of 1 m/s.
   b. a mass of 1 kilogram to accelerate at 1 $m/s^2$.
   c. an object to increase its velocity to 1 $m/s^2$.
   d. any stationary object to start moving.
4. What is the net force acting on the object pictured below?


   a. 7 N to the right
   b. 7 N to the left
   c. 2 N to the right
   d. 3 N to the left
5. If two forces act on an object in the same direction
   a. the net force is greater than either of the two forces.
   b. the net force equals the sum of the two forces.
   c. the two forces are always balanced.
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. The force of gravity acting on an object is measured by weight.

_____ 7. Examples of forces include friction, gravity, and velocity.

_____ 8. Equal but opposite forces pushing on the same object produce a net force of zero on the object.

_____ 9. The length of a force arrow represents the direction of the force.

_____ 10. Force can cause a moving object to stop moving.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Any push or pull acting on an object is a(n) _____.

12. The force that a person or thing exerts on an object is called _____ force.

13. The SI unit for force is the _____.

14. The combination of all the forces acting on an object is known as the _____ force.

15. When opposing forces are not equal in strength, the forces are said to be _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Identify the forces acting on you when you are standing still. Explain why the forces do not cause you to move.

17. Compare and contrast balanced and unbalanced forces.

## Answer Key

1. b 2. b 3. b 4. d 5. d

6. true 7. false 8. true 9. false 10. true

11. force 12. applied 13. newton (N) 14. net 15. unbalanced

16. When you are standing still, the force of gravity is pulling you down toward the center of Earth. At the same time, the ground or whatever you are standing on is pushing up on you with an equal but opposite force. These two forces are balanced, so there is a net force of zero acting on you. This explains why the forces do not cause you to move.

17. Both balanced and unbalanced forces refer to forces that are acting on the same object but in opposite directions. If the two opposing forces are equal in strength, then the forces are balanced and the net force is zero. If the two forces are not equal in strength, then the forces are unbalanced and the net force is greater than zero.

# 13.2 Friction

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Friction is greater when surfaces are
   a. rougher.
   b. smoother.
   c. smaller.
   d. two of the above
2. Rubbing your hands together makes them warmer because
   a. friction causes molecules to move faster.
   b. rubbing causes chemical reactions.
   c. rubbing causes skin cells to release enzymes.
   d. none of the above
3. Which way of moving a box produces no friction?
   a. sliding the box across the floor
   b. rolling the box on a dolly
   c. picking up the box and carrying it
   d. none of the above
4. Why do ball bearings reduce friction in a wheel?
   a. Ball bearings prevent the wheel from sliding on the road.
   b. Rolling friction is less than sliding friction.
   c. Ball bearings roll instead of slide.
   d. two of the above
5. Fluid friction is greater when the object moving through the fluid is
   a. larger.
   b. smaller.
   c. faster.
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Friction is a force that opposes motion.

_____ 7. The force of friction between surfaces is always useful.

_____ 8. Sliding friction is greater when the sliding object is heavier.

_____ 9. Sliding friction is stronger than static friction.

_____ 10. Rolling friction is weaker than sliding friction.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The type of friction that occurs between an object and the fluid it moves through is called _____ friction.

12. The type of friction that occurs between the wheels of a car and the road is called _____ friction.

13. Friction always produces energy in the form of _____.

14. You can stand on the floor without slipping because of _____ friction.

15. Fluid friction with air is called _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Identify a type of friction that opposes the forward motion of a runner.

17. Explain how you might reduce the sliding friction between two surfaces.

## Answer Key

1. a 2. a 3. d 4. d 5. d

6. true 7. false 8. true 9. false 10. true

11. fluid 12. rolling 13. heat 14. static 15. air resistance

16. The forward motion of a runner is opposed by fluid friction. The movement of the runner's body through the air creates air resistance, which is a type of fluid friction.

17. To reduce the sliding friction between two surfaces you could make them smoother. For example, you could sand wooden surfaces to make them smoother or put oil on metal surfaces to make them more slippery.

# 13.3 Gravity

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The SI unit for weight is the
   a. gram.
   b. kilogram.
   c. newton.
   d. pound.
2. Newton's law of universal gravitation states that the force of gravity
   a. affects all objects in the universe.
   b. is stronger for objects with more mass.
   c. is stronger for objects that are closer together.
   d. all of the above
3. Gravity causes all objects to
   a. attract one another.
   b. have projectile motion.
   c. accelerate when they fall toward Earth.
   d. two of the above
4. The only reason that a leaf falls to the ground more slowly than an acorn is that the leaf has
   a. less mass.
   b. more air resistance.
   c. a weaker force of gravity.
   d. less acceleration due to gravity.
5. On Earth, a mass of 1 kilogram exerts a downward force due to gravity of about
   a. 1 N.
   b. 5 N.
   c. 10 N.
   d. 15 N.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. All of the solar systems in the universe formed because of gravity.

_____ 7. Gravity acts only between objects that are close together or touching.

_____ 8. Earth has stronger gravity than the moon.

_____ 9. Weight is measured with a balance.

_____ 10. People have known about gravity for thousands of years.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The force of attraction between two masses is known as _____.

12. _____ measures the force of gravity pulling on an object.

13. The law of universal gravitation was proposed by _____.

14. _____ showed that gravity is an effect of curves in space and time.

15. The moon's path around Earth is called a(n) _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Assume that you drop a rock from the top of a tall cliff and it takes 3 seconds for the rock to fall to the bottom of the cliff. What is the rock's velocity when it reaches the bottom? How do you know?

17. When you shoot an arrow at a target, why should you aim above the bull's eye if you want the arrow to hit the bull's eye?

## Answer Key

1. c 2. d 3. d 4. b 5. c

6. true 7. false 8. true 9. false 10. true

11. gravity 12. Weight 13. Newton 14. Einstein 15. orbit

16. When the rock reaches the bottom of the cliff, its velocity is 29.4 m/s. Like all falling objects, the rock accelerates toward Earth because of gravity at a rate of 9.8 m/s$^2$. Therefore, after three seconds, its velocity is: 3 s $\times$ 9.8 m/s$^2$ = 29.4 m/s.

17. When you shoot an arrow at a target, you should aim above the bull's eye because the arrow will have projectile motion. This occurs when an object is subject to horizontal force (from the bow) and to downward force (due to gravity). The path of the arrow will start out parallel to the ground and slowly curve downward. Therefore, if you aim above the bull's eye, the arrow will curve downward to hit the bull's eye.

# 13.4 Elastic Force

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which of the following items has the property of elasticity?
   a. rubber band
   b. paper clip
   c. toothpick
   d. iron nail
2. When does an elastic material exert elastic force?
   a. before it is stretched
   b. as it is stretched
   c. when it is released
   d. two of the above
3. What happens when you pull on a bungee cord?
   a. It stretches.
   b. It resists the change in shape.
   c. It exerts force in the opposite direction.
   d. all of the above
4. When you jump on a trampoline, the surface of the trampoline
   a. changes shape.
   b. exerts elastic force.
   c. pushes you up into the air.
   d. all of the above
5. Elastic force causes an elastic material to
   a. push back when pulled.
   b. return to its original shape.
   c. take the shape of its container.
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. When you compress a spring, it resists the change in shape.

_____ 7. Paper is an example of an elastic material.

_____ 8. As you stretch a bungee cord, its elastic force gets stronger.

_____ 9. When you release a stretched bungee cord, it returns to its original shape because of gravity.

_____ 10. Something that is elastic returns to its original shape after being compressed.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The counter force exerted by an elastic material that is stretched is called _____.

12. _____ is the ability of a material to return to its original shape after being stretched or compressed.

13. A bungee cord can stretch without breaking because it is _____.

14. When you use a resistance band, the resistance you feel is _____.

15. An elastic material resists changes in _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Changes in shape that occur because of elastic force are physical changes in matter. Explain why.

17. A pogo stick contains a spring. What happens to the spring when you jump on it? Why does the pogo stick allow you to jump higher than you could without it?

## Answer Key

1. a 2. d 3. d 4. d 5. d

6. true 7. false 8. true 9. false 10. true

11. elastic force 12. Elasticity 13. elastic 14. elastic force 15. shape

16. Shape is a physical property of matter. When matter changes shape, it is still the same kind of matter. Therefore, changes in shape are physical changes in matter.

17. When you jump on the spring in a pogo stick, it compresses. After the spring reaches its maximum compression, it springs back to its original shape and exerts elastic force. This force pushes the pogo stick upward and allows you to jump higher than you could without the help of the spring.

# 13.5 Forces

## Chapter Test

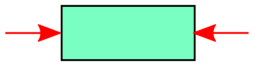
**Name_____ Class_____ Date_____**

**Multiple Choice**

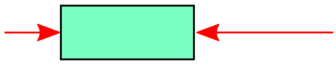
*Circle the letter of the correct choice.*

1. Which diagram represents balanced forces?

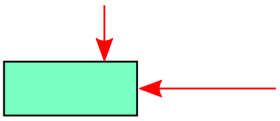
a.



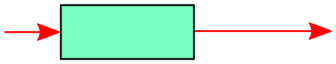
b.



c.



d.



2. Which pair of forces in question 1 will cause the object to move to the right?
   a. a
   b. b
   c. c
   d. d
3. Which type of friction do you use when you put on the brakes to stop a bike?
   a. static friction
   b. stopping friction
   c. rolling friction
   d. sliding friction
4. Why does engine oil help prevent an engine from overheating?
   a. It causes chemical reactions that absorb energy.
   b. It reduces friction between moving parts.
   c. It has a higher melting point than metal.
   d. It makes the engine run more slowly.
5. You would weigh less on the moon than on Earth because
   a. you would have less mass on the moon.
   b. the moon has weaker gravity than Earth.

c. the moon has a thinner atmosphere than Earth.
d. two of the above

6. Albert Einstein was the first person to show that gravity is

a. exerted by all objects on all other objects.
b. stronger between objects with greater mass.
c. stronger between objects that are closer together.
d. caused by curves in space and time around massive objects.

7. Examples of objects that make use of elastic force include

a. hair scrunchies.
b. pogo sticks.
c. trampolines.
d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. The SI unit for weight is the pound.

_____ 9. Forces acting in the same direction are subtracted to yield the net force.

_____ 10. Stationary objects generally have at least two forces acting on them.

_____ 11. Static friction is weaker than sliding friction.

_____ 12. Fluid friction is stronger when an object moves more slowly through a fluid.

_____ 13. A pebble falls to the ground more quickly than a sheet of paper because the pebble has greater mass.

_____ 14. The law of universal gravitation was proposed by Isaac Newton.

_____ 15. Both arrows and cannon balls have projectile motion.

_____ 16. When you stretch a spring, it resists the change in shape.

_____ 17. Rubber is an example of an elastic material.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. The newton is the SI unit for _____.

19. The difference between two opposing forces is called the _____ force.

20. The force that opposes motion between any two surfaces is _____.

21. _____ friction makes it possible to walk on a sidewalk without slipping.

22. Anything that has mass exerts a force of _____ on any other mass.

23. After falling toward Earth for 2 seconds, an object ideally has a velocity of _____.

24. Gas molecules are attracted toward each other because of the force of _____.

25. A stretched bungee cord returns to its original shape because it has the property of _____.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Outline the relationships between forces and motion.

27. Explain why it is easier to move a heavy box on a dolly than it is to slide the box over the ground.

28. Identify two forces that come into play when you jump on a trampoline. Explain how the forces work.

## Answer Key

1. a 2. d 3. d 4. b 5. b 6. d 7. d

8. false 9. false 10. true 11. false 12. false 13. false 14. true 15. true 16. true 17. true

18. force 19. net 20. friction 21. Static 22. gravity 23. 19.6 m/s 24. gravity 25. elasticity

26. Any time the motion of an object changes, a force has been applied. Force can cause a stationary object to start moving or a moving object to accelerate. The moving object may change its speed, its direction, or both. How much an object's motion changes when a force is applied depends on the strength of the force and the object's mass. When two forces are applied to the same object, how the object's motion changes is determined by the net force. If the two forces are applied in opposite directions, the net force is the difference between the two forces. If the forces are equal in strength, the net force is zero and the object's motion does not change. If the forces are unequal in strength, the net force is greater than zero and the object moves in the direction of the stronger of the two forces. If the two

forces are applied in the same direction, the net force is the sum of the two forces, so the object's motion will change more than if just one of the forces is applied.

27. It is easier to move a heavy box on a dolly than it is to slide the box over the ground because the wheels of the dolly roll over the ground and rolling friction is weaker than sliding friction. Therefore, it takes less force to overcome the rolling friction of the wheels than the sliding friction of the box.

28. A jumper on a trampoline is subject to the force of gravity and elastic force. The elasticity of the trampoline causes it to stretch and then spring back to its original shape when the jumper jumps on it. The elastic force pushes the jumper upward. The force of gravity then pulls the jumper back down to the trampoline, and the cycle repeats.

# CHAPTER 14 Newton's Laws of Motion Assessments

## Chapter Outline



# 14.1 Newton's First Law

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Newton's first law of motion is also called the law of
   a. mass.
   b. inertia.
   c. velocity.
   d. unbalanced forces.
2. Once an applied force causes an object to start moving, the object keeps moving because
   a. the force continues to be applied to it.
   b. no other force is acting on it.
   c. it has inertia.
   d. none of the above
3. If the net force acting on any object is zero, the object will
   a. not move.
   b. change its motion.
   c. have zero velocity.
   d. none of the above
4. If you run into a curb on your bike, you might fly forward over the handlebars because of
   a. air resistance.
   b. inertia.
   c. friction.
   d. gravity.
5. Inertia causes a stationary object to
   a. start moving.
   b. remain stationary.
   c. have an increase in velocity.
   d. change its speed or direction.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Newton's first law relates motion to balanced and unbalanced forces.

_____ 7. An object with greater mass has greater inertia.

_____ 8. Balanced forces are needed to change an object's motion.

_____ 9. A rolling ball will roll forever unless it runs into another object.

_____ 10. The tendency of an object to resist a change in its motion depends on the object's size.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ is the tendency of an object to resist a change in its motion.

12. An object's motion will change only if a(n) _____ force acts on the object.

13. The force of _____ opposes the movement of objects.

14. The inertia of an object depends on the object's _____.

15. _____ force is the combination of all the forces acting on an object.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Define inertia and relate the concept of inertia to the motion of objects.

17. Apply Newton's first law of motion to a sprinter in a race.

## Answer Key

1. b 2. c 3. d 4. b 5. b

6. true 7. true 8. false 9. false 10. false

11. Inertia 12. unbalanced 13. friction 14. mass 15. Net

16. Inertia is the tendency of an object to resist a change in its motion. If an object is at rest, inertia will keep it at rest. If an object is moving, inertia will keep it moving.

17. Newton's first law of motion states that an object's motion will not change unless an unbalanced force acts on the object. Before the race begins, the runner is stationary. To overcome her inertia and start running, she uses her muscle power to apply unbalanced force. After the runner crosses the finish line, her muscles provide the unbalanced force that allows her to overcome inertia and stop running.

# 14.2 Newton's Second Law

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which two factors have an inverse relationship?
   a. force and acceleration
   b. force and mass
   c. mass and gravity
   d. mass and acceleration
2. Any change in the motion of an object is called
   a. speed.
   b. velocity.
   c. direction.
   d. acceleration.
3. In the equation $F = m \times a$, if $a$ is the acceleration due to gravity, what is $F$?
   a. mass
   b. weight
   c. friction
   d. frequency
4. If you push a 20-kg box with a force of 10 N, what is its acceleration?
   a. 20 $m/s^2$
   b. 10 $m/s^2$
   c. 2 $m/s^2$
   d. 0.5 $m/s^2$
5. Newton determined that the acceleration of an object depends on the net force acting on the object and the object's
   a. size.
   b. mass.
   c. weight.
   d. velocity.

*True or False'*

*Write true if the statement is true or false if the statement is false.*

_____ 6. Newton's second law shows that there is a direct relationship between net force and acceleration.

_____ 7. Doubling the mass of an object doubles its weight.

_____ 8. Force can be expressed as kg • m/s.

_____ 9. Any object that is accelerating is changing its speed.

_____ 10. If a balanced force acts on an object, the object will accelerate.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Acceleration is a measure of the change in _____ of an object.

12. Newton's second law shows that there is a(n) _____ relationship between the acceleration of an object and its mass.

13. Increasing the net force on a given object _____ the object's acceleration.

14. _____ is a measure of the force of gravity pulling on an object of a given mass.

15. The acceleration of any object due to gravity is _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. People often think that mass and weight measure the same thing. Explain why this is incorrect.

17. Explain how the following factors are related to one another for a given object: net force, mass, and acceleration.

## Answer Key

1. d 2. d 3. b 4. d 5. b

6. true 7. true 8. false 9. false 10. false

11. velocity 12. inverse 13. increases 14. Weight 15. 9.8 $m/s^2$

16. Although mass and weight are directly related, they do not measure the same thing. Mass is a measure of the amount of matter in an object, whereas weight is a measure of the force of gravity pulling down on an object of a

given mass.

17. Acceleration of a given object is directly related to the net force acting on the object and inversely related to the mass of the object. For example, if the net force on the object doubles, so does the acceleration of the object. On the other hand, if the mass of the object doubles, its acceleration is only half as great.

# 14.3 Newton's Third Law

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. What happens when a boater pushes against the water with an oar?
    a. The water pushes back.
    b. The boat moves in the opposite direction.
    c. The oar moves the boat.
    d. two of the above
2. Action and reaction forces are not balanced because they
    a. are unequal in strength.
    b. act in the same direction.
    c. act on different objects.
    d. cancel each other out.
3. An object has greater momentum if it has
    a. smaller size.
    b. greater mass.
    c. greater velocity.
    d. two of the above
4. Which statement about momentum is false?
    a. Momentum is a force.
    b. Momentum may be transferred.
    c. Momentum is always conserved.
    d. Momentum is a property only of moving objects.
5. The momentum of a 50-kg object moving at a velocity of 2 m/s is
    a. 100 kg • m/s
    b. 50 kg • m/s
    c. 25 kg • m/s
    d. 2 kg • m/s

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Momentum is a measure of an object's velocity.

_____ 7. If you double the velocity of an object, its momentum also doubles.

_____ 8. The law of conservation of momentum applies to actions and reactions.

_____ 9. After two objects collide, their combined momentum is always zero.

_____ 10. A bowling ball has greater momentum than a softball if both have the same velocity.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ is a property of a moving object that makes the object hard to stop.

12. An object's momentum equals its mass multiplied by its _____.

13. Equal and opposite forces that act on the same object are called _____ forces.

14. According to Newton's third law of motion, _____ always act in pairs.

15. A reaction force is always _____ and opposite to the action force.

*Short Answer'*

*Answer the following questions in complete sentences.*

16. Momentum is a property of an object, but it is not always the same for a given object. Explain why.

17. Apply Newton's third law of motion to the action of serving a volleyball.

## Answer Key

1. d 2. c 3. d 4. a 5. a

6. false 7. true 8. true 9. false 10. true

11. Momentum 12. velocity 13. balanced 14. forces 15. equal

16. Momentum is a property of an object that depends on the mass and velocity of the object. If the mass or velocity of the object change, the object's momentum also changes. This explains why momentum is not always the same for a given object.

17. Newton's third law of motion states that every action has an equal and opposite reaction. When you serve a volleyball, you apply force to the ball with your serving hand. The is the action force. The reaction force is applied by the ball to your hand. This force is equal but opposite to the action force and causes the ball to move away from you and across the net to the other side of the court.

# 14.4 Newton's Laws of Motion

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. What is always required to overcome inertia?
   a. force of friction
   b. force of gravity
   c. unbalanced force
   d. two of the above
2. An object at rest will stay at rest as long as the net force acting on it is
   a. positive.
   b. strong.
   c. stable.
   d. zero.
3. Inertia causes a moving object to
   a. keep moving.
   b. stop moving.
   c. slow down.
   d. speed up.
4. The inertia of an object depends on its
   a. mass.
   b. speed.
   c. velocity.
   d. direction.
5. The acceleration of an object is inversely related to its
   a. mass.
   b. speed.
   c. weight.
   d. velocity.
6. If you apply 10 N of force to a 10-kg object, what will be the object's acceleration?
   a. 10 $m/s^2$
   b. 10 N/kg
   c. 1 $m/s^2$
   d. 1 kg/N
7. What is the SI unit for momentum?
   a. $kg/s^2$

b. kg • $m/s^2$
c. kg • s/m
d. none of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Newton's first law of motion applies only to stationary objects.

_____ 9. It takes more force to start running than to keep running.

_____ 10. It is harder to stop a 60-kg football player than a 40-kg football player if they have the same velocity.

_____ 11. An object's acceleration depends on its mass and speed.

_____ 12. If you increase the net force acting on an object, its acceleration also increases.

_____ 13. Newton's second law of motion applies only to objects that are moving.

_____ 14. If you know an object's mass, you also know its weight because mass and weight measure the same thing.

_____ 15. Newton's third law of motion describes how forces act in pairs.

_____ 16. When objects collide, momentum is usually lost.

_____ 17. Momentum is a type of force.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. Newton's _____ law of motion is also known as the law of inertia.

19. A stationary object resists movement because of _____

20. Inertia is greater when objects have greater _____.

21. Newton's _____ law of motion relates acceleration to force and mass.

22. An object will accelerate only if the net force acting on the object is greater than _____.

23. The _____ of an object is equal to its mass multiplied by the acceleration due to gravity.

24. According to Newton's _____ law of motion, every action has an equal and opposite reaction.

25. Two objects with the same velocity have the same momentum only if they also have the same _____.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Explain this statement: Because of inertia, seatbelts save lives.

27. How does Newton's second law of motion explain the weight of an object?

28. Describe an example of Newton's third law of motion.

## Answer Key

1. c 2. d 3. a 4. a 5. a 6. c 7. d

8. false 9. true 10. true 11. false 12. true 13. false 14. false 15. true 16. false 17. false

18. first 19. inertia 20. mass 21. second 22. zero 23. weight 24. third 25. mass

26. Because of inertia, if a car's velocity changes suddenly (for example, due to a crash), the passengers of the car keep moving in the same direction they were going. Without seatbelts, they might be thrown around in the car or even thrown out of the car. They are less likely to be injured or killed if seatbelts restrain them and prevent their continued motion.

27. Newton's second law of motion states that the acceleration of an object is equal to the net force applied to the object divided by the object's mass. This can be restated as: the net force applied to an object is equal to the object's mass multiplied by its acceleration. If the acceleration of an object is due to gravity, then multiplying its mass by the acceleration due to gravity gives you the object's weight. That's because weight is a measure of the force of gravity on an object of a given mass.

28. Answers may vary but should be a description of an action and its equal and opposite reaction. *Sample answer*: An example of Newton's third law is swimming. Pushing against the water with your arms and legs is the action. In reaction, the water pushes back with equal force, causing you to move forward through the water.

# CHAPTER 15 Fluid Forces Assessments

## Chapter Outline



# 15.1 Pressure of Fluids

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Why can you fill a balloon with air by blowing air into it through a single small opening?
   a. Particles of a fluid always spread out to fill their container.
   b. Pressure of a fluid is greater when the same force is applied to a larger area.
   c. Particles of a fluid always move from an area of lower pressure to an area of higher pressure.
   d. two of the above
2. Assume that you apply 10 Pa of pressure to the head of a thumbtack. How much pressure will the point of the tack apply to a corkboard?
   a. 0 Pa
   b. less than 10 Pa
   c. exactly 10 Pa
   d. more than 10 Pa
3. Which of the following is the SI unit for pressure?
   a. N
   b. N/m
   c. $N/m^2$
   d. none of the above
4. If you know how much pressure is applied to a given area, you can calculate the force exerted on the area by
   a. multiplying pressure by area.
   b. subtracting pressure from area.
   c. dividing pressure by area.
   d. adding pressure to area.
5. It is harder for people to breathe in adequate oxygen at high altitudes because
   a. there is a smaller percentage of oxygen in high-altitude air.
   b. the atmosphere is denser high above sea level.
   c. air pressure is lower at high altitudes.
   d. none of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Pressure is a force that is exerted only by fluids.

_____ 7. Bernoulli's law explains why ketchup squirts out of a packet when pressure is applied to the other end.

_____ 8. Pascal's law explains how a hydraulic lift works.

_____ 9. Particles of a fluid exert pressure in all directions.

_____ 10. The spoiler on a racecar causes air pressure to push the car down toward the track.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ law states that a change in pressure is transmitted equally throughout a fluid.

12. Denser fluids exert _____ pressure than less dense fluids.

13. _____ law states that pressure in a moving fluid is less when the fluid is moving more quickly.

14. The upward force that allows birds and airplanes to fly is called _____.

15. The pressure of ocean water is _____ at the bottom of the ocean than it is at the surface.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Does a gymnast exert more pressure on the floor when she does a handstand or when she does a split? Explain your answer.

17. Describe how a hydraulic lift transmits pressure and increases the force applied to the hydraulic fluid.

## Answer Key

1. a 2. d 3. c 4. a 5. c

6. false 7. false 8. true 9. true 10. true

11. Pascal's 12. greater 13. Bernoulli's 14. lift 15. greater

16. When a gymnast stands on her hands, she exerts the same amount of force (her weight) over a smaller area than when she does a split. Therefore, she exerts more pressure on the floor when she does a handstand.

17. In a hydraulic lift, force is placed on a fluid in a narrow cylinder, and the fluid transmits the pressure throughout the hydraulic system. When the pressure reaches the fluid in a wider cylinder, it forces the wider cylinder upward, along with the car that rests on it. The force applied to the car is much greater than the force applied to the fluid in the narrow cylinder because when pressure acts over a wider area, it creates a larger force.

# 15.2 Buoyancy of Fluids

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which statement is true about weight and buoyant force?
   a. They work in opposite directions.
   b. They are always equal in strength.
   c. They determine whether an object floats.
   d. two of the above
2. Some objects float in water because the objects
   a. weigh less than the weight of the water they displace.
   b. have less mass when they are placed in water.
   c. have greater density than water.
   d. have the property of buoyancy.
3. The amount of water that is displaced when you submerge yourself in a swimming pool is equal to your body's
   a. surface area.
   b. volume.
   c. weight.
   d. mass.
4. The weight of the displaced water in question 3 equals the
   a. force of gravity acting on your body.
   b. buoyant force acting on your body.
   c. weight of your body.
   d. two of the above
5. What happens if an object is placed in water and its density is greater than water?
   a. The object always sinks.
   b. The object always floats.
   c. The object may sink or float.
   d. The object's density decreases.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Objects float because fluids exert only upward pressure.

_____ 7. Buoyancy is a property of some objects when placed in fluids.

_____ 8. If two objects have the same volume but differ in density, the denser object will weigh more.

_____ 9. Archimedes' law explains why heavy objects can float if they displace enough water.

_____ 10. The buoyant force acting on an object in a fluid depends on the total volume of the fluid.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The ability of a fluid to exert an upward force on any object placed in the fluid is called _____.

12. If an object's weight is less than the buoyant force acting on the object, then the object will _____.

13. _____ determined that the amount of fluid displaced by an object equals the object's volume.

14. The buoyant force acting on an object equals the _____ of the fluid displaced by the object.

15. Buoyant force occurs because a fluid exerts greater _____ at greater depth.

**Short Answer**

*Answer the following questions in complete sentences.*

16. What explains buoyant force?

17. Why do icebergs float on ocean water?

## Answer Key

1. d 2. a 3. b 4. b 5. c

6. false 7. false 8. true 9. true 10. false

11. buoyancy 12. float 13. Archimedes 14. weight 15. pressure

16. A fluid exerts pressure in all directions, but the pressure is greater at greater depth. Therefore, the fluid below an object exerts greater force on the object than the fluid above the object. This explains why there is an overall upward force, called buoyant force, exerted on the object.

17. Water is denser than ice. Because of its greater density, the water displaced by an iceberg weighs more than the iceberg. This means that the buoyant force acting on the iceberg is greater than the iceberg's weight. When the buoyant force acting on an object is greater than the weight of the object, the object floats, explaining why icebergs float on ocean water.

# 15.3 Fluid Forces

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. When a fluid fills a closed container, it exerts pressure
   a. only on the bottom of the container.
   b. only on the sides of the container.
   c. only on particles within the fluid.
   d. everywhere inside the container.
2. Fluids exert pressure because they
   a. contain force particles.
   b. are confined to a small area.
   c. have constantly moving particles.
   d. all of the above
3. The SI unit for pressure is named for the scientist who discovered that pressure is
   a. transmitted equally throughout an enclosed fluid.
   b. greater on Mount Everest that at sea level.
   c. transmitted only from gases to liquids.
   d. greater in a faster moving fluid.
4. To find the pressure exerted by a force on a given area, you should
   a. multiply the force by the area.
   b. divide the force by the area.
   c. add the force to the area.
   d. none of the above
5. Ice floats on water because water has greater
   a. mass.
   b. density.
   c. volume.
   d. movement.
6. The ability of a fluid to exert upward force on objects placed in the fluid is known as
   a. weight.
   b. floating.
   c. buoyancy.
   d. buoyant force.
7. The buoyant force acting on an object in a fluid equals the
   a. weight of the object.

b. force of gravity pulling down on the object.
c. weight of the fluid displaced by the object.
d. none of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. The pressure of ocean water is greatest at the surface.

_____ 9. When you calculate pressure from force and area, the answer should be in the unit N/m.

_____ 10. When pressure acts over a larger area it creates a weaker force.

_____ 11. Differences in fluid pressure allow you to suck fluid through straw.

_____ 12. Hydraulic fluid is used to increase force in brakes and bulldozers.

_____ 13. Air pressure is greater above an airplane wing than below it.

_____ 14. Air flows out of the lungs when the lungs and ribs contract.

_____ 15. Only fluids have the property of buoyancy.

_____ 16. A rubber duck floats on water because it weighs less than the water it displaces.

_____ 17. Buoyant force occurs because fluid pressure decreases with greater depth.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. _____ shows how concentrated a force is on a given area.

19. When a force is applied over a smaller area, pressure is _____.

20. The SI unit for pressure is the called the _____.

21. Air exerts less pressure than water because air is _____ dense than water.

22. The muscle that expands and contracts your lungs so you can breathe is the _____.

23. _____ law explains why a bird's wing creates lift.

24. The upward force exerted on an object in a fluid is called _____ force.

25. The force in question 24 equals the _____ of the fluid displaced by the object.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Explain how and why pressure changes with depth in a fluid.

27. Apply Bernoulli's law to explain how the spoiler on a racecar works.

28. Some very heavy objects float on water. Explain how.

## Answer Key

1. d 2. c 3. a 4. b 5. b 6. c 7. c

8. false 9. false 10. false 11. true 12. true 13. false 14. true 15. true 16. true 17. false

18. Pressure 19. greater 20. pascal (Pa) 21. less 22. diaphragm 23. Bernoulli's 24. buoyant 25. weight

26. As you go deeper in a fluid, the fluid exerts more pressure. That's because the deeper you go in a fluid, the greater the weight of all the fluid pressing down on you from above. With more force (weight) on a given area, the pressure is greater at greater depth.

27. Bernoulli's law states that a faster moving fluid exerts less pressure. A spoiler on a racecar is designed to have air moving more slowly over it than under it. This makes air pressure greater over the spoiler than under it. The net result is that air pressure pushes downward on the spoiler, and the pressure helps the car hug the track.

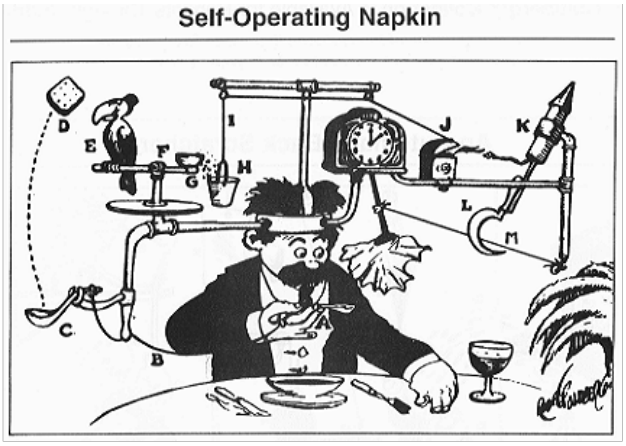
28. Some very heavy objects float on water because the water they displace weighs more than the objects weigh. According to Archimedes' law, the buoyant force acting on an object in a fluid equals the weight of the fluid displaced by the object. If the weight of the water (and therefore the buoyant force) is greater than the object's weight, then the object will float.

CHAPTER 16

# Work and Machines Assessments

## Chapter Outline






**How the Self-Operating Napkin Works:**

1. The man raises the soup spoon (A) to his mouth. This movement pulls the string (B), which jerks the ladle (C).
2. The ladle throws the cracker (D) past the parrot (E), which jumps for the cracker, causing the perch (F) to tilt.
3. When the perch tilts, it upsets the seeds (G) into the pail (H). The extra weight in the pail pulls the cord (I), which opens and lights the lighter (J).
4. The lighter sets off the skyrocket (K), which causes the sickle (L) to cut the string (M).
5. When the string is cut, it allows the pendulum with the attached napkin to swing back and forth, thereby wiping the man's chin.

# 16.1 Work

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Assume that a friend hands you a 15-newton box to hold for her. If you hold the box without moving it at a height of 1.5 meters above the ground, how much work do you do?
   a. 22.5 J
   b. 15 J
   c. 10 J
   d. none of the above
2. Which weight lifter described below does the most work?
   a. Tom lifts 195 N a distance of 2.0 m.
   b. Ted lifts 190 N a distance of 2.1 m.
   c. Tad lifts 185 N a distance of 2.2 m.
   d. Tim lifts 180 N a distance of 2.3 m.
3. Another way of writing 1 joule is
   a. 1 N • m.
   b. 1 N/m.
   c. 1 N • $m^2$.
   d. 1 $N/m^2$.
4. One horsepower is about equal to
   a. 1 watt.
   b. 75 watts.
   c. 745 watts.
   d. 1 kilowatt.
5. How much work is done by a 1000-watt hairdryer in 40 seconds?
   a. 0.4 J
   b. 25 J
   c. 960 J
   d. 40,000 J

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Every time you apply a force you do work

_____ 7. A more powerful device can do more work in the same amount of time than a less powerful device.

_____ 8. The power of a machine equals the work it does multiplied by the time it takes to do that work.

_____ 9. The steam engine invented by James Watt had the power of one horse.

_____ 10. The most powerful engines today can produce more than 100,000 horsepowers.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The use of force to move an object is called _____.

12. The SI unit for work is the _____.

13. _____ is a measure of the amount of work that can be done in a given amount of time.

14. The SI unit for power is the _____.

15. Work can be calculated as power multiplied by _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Contrast how the term work is used in physics with its use in everyday language.

17. When Suri uses a 2000-watt hairdryer, she can dry her hair in 2 or 3 minutes. When she uses a 1000-watt hairdryer, it takes about 5 minutes to dry her hair. Explain why.

## Answer Key

1. d 2. d 3. a 4. c 5. d

6. false 7. true 8. false 9. false 10. true

11. work 12. joule 13. Power 14. watt 15. time

16. *Sample answer*: In everyday language, work is a chore or other useful task, or a job done for money. Work in this sense may include physical labor as well as tasks that require no motion, such as simply thinking. In physics, work

is defined differently, as the use of force to move an object. Work in physics includes only activities that involve motion, including physical labor, sports, and other activities we typically think of as play. On the other hand, tasks such as thinking that do not involve motion are not considered work in physics.

17. The 2000-watt hairdryer has twice the power of the 1000-watt hairdryer. A more powerful device can do the same amount of work in less time. This explains why it takes only about half as much time for Suri to dry her hair with the 2000-watt hairdryer as it does with the 1000-watt hairdryer.

# 16.2 Machines

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Machines that increase the distance over which force is applied include
   a. hammers.
   b. doorknobs.
   c. nutcrackers.
   d. pry bars.
2. Ways that machines make work easier include
   a. increasing force.
   b. increasing work.
   c. increasing efficiency.
   d. all of the above
3. If you apply 20 N of force to the handle end of a canoe paddle, how much force might the paddle end apply to the water?
   a. 40 N
   b. 30 N
   c. 20 N
   d. 10 N
4. If the output work of a machine is 3000 J and the input work is 4000 J, what is the efficiency of the machine?
   a. 133%
   b. 100%
   c. 75%
   d. 66%
5. If the ideal mechanical advantage of a machine equals 1, then the actual mechanical advantage of the machine must be
   a. greater than 1.
   b. equal to 1.
   c. less than 1.
   d. less than zero.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. The output force of a machine is always less than the input force.

_____ 7. A machine changes the way that work is done.

_____ 8. All machines change the direction in which force is applied.

_____ 9. A machine that applies force over a longer distance also increases the strength of the force.

_____ 10. A pry bar changes the strength, distance, and direction of the input force.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Any device that makes work easier by changing a force is a(n) _____.

12. The percent of work put into a machine that becomes output work is the machine's _____.

13. The number of times a machine multiplies the force applied to the machine is the machine's _____.

14. The distance over which the force is applied by a machine is called the _____ distance.

15. The efficiency of a machine is reduced when there is more _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. A heavy object can be pushed up a ramp or wheeled up a ramp on a dolly. Which way of moving the object up the ramp is more efficient? Explain your answer.

17. Compare and contrast the actual and ideal mechanical advantage of machines.

## Answer Key

1. a 2. a 3. d 4. c 5. c

6. false 7. true 8. false 9. false 10. true

11. machine 12. efficiency 13. mechanical advantage 14. output 15. friction

16. It is more efficient to wheel a heavy object up a ramp on a dolly than to push the object up the ramp. Efficiency is measure of how well a machine reduces friction, and the friction of the dolly's wheels rolling up the ramp is much less than the friction of the object sliding up the ramp.

17. The mechanical advantage of a machine is the number of times it multiplies the input force. The actual mechanical advantage of a machine takes into account the reduction in output force that is due to friction. It shows how much a machine actually multiplies force when it is used in the real world. It is calculated by dividing the output force by the input force. The ideal mechanical advantage, in contrast, represents the multiplication of input force that would be achieved by the machine if there were no friction. It is calculated by dividing the input distance by the output distance. The ideal mechanical advantage is always greater than the actual mechanical advantage because all machines use up some work to overcome friction.

# 16.3 Simple Machines

## Lesson Quiz

*Name*_____ *Class*_____ *Date*_____'

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which type of simple machine is the head of an axe?
    a. wedge
    b. lever
    c. screw
    d. none of the above
2. Which of the following is a second-class lever?
    a. seesaw
    b. chisel
    c. wheelbarrow
    d. hockey stick
3. The ideal mechanical advantage of a pulley equals the
    a. number of rope segments lifting up on the object.
    b. length of the rope segments between the pulley and the object.
    c. height of the pulley above the surface of the ground.
    d. number of rope segments between the pulley and the beam.
4. Which statement about a wheel and axle is true?
    a. It consists of two simple machines.
    b. It changes the direction of the applied force.
    c. It changes the distance over which the force is applied.
    d. two of the above
5. The ideal mechanical advantage of an inclined plane is always
    a. less than one.
    b. equal to one.
    c. greater than one.
    d. less than zero.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. The center of a wheel and axle is called the fulcrum.

_____ 7. A wedge is used to cut or split objects.

_____ 8. When you turn a screw, you apply force along its inclined plane.

_____ 9. A lever may or may not change the strength of the applied force.

_____ 10. The wheel of a wheel and axle turns more slowly than the axle.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Two types of simple machines that contain inclined planes are wedges and _____.

12. The type of simple machine you would use to pry a nail out of a board is a(n) _____.

13. A _____ class lever changes the direction of the input force.

14. The _____ is the smaller of the two rings in a wheel and axle.

15. A grooved wheel and rope make up the simple machine called a(n) _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. A hammer is a lever than can be used to pound a nail into a board or to pry a nail out of a board. Which class of lever is the hammer in each case? Explain your answer.

17. Describe how force changes when it is applied to the axle of a wheel and axle.

## Answer Key

1. a 2. c 3. a 4. c 5. c

6. false 7. true 8. true 9. true 10. false

11. screws 12. lever 13. first 14. axle 15. pulley

16. When a hammer is used to pound a nail into a board, it is a third class lever because both input and output forces are on the same side of the fulcrum and the input force is closer to the fulcrum. When a hammer is used to pry a nail

out of a board, it is a first class lever because input and output forces are on opposite sides of the fulcrum.

17. When force is applied to the axle of a wheel and axle, it causes the wheel to turn in the same direction. The output force is weaker than the input force but it is applied over a greater distance because the wheel is larger than the axle.

# 16.4 Compound Machines

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Simple machines in a pair of scissors include
   a. two levers.
   b. two wedges.
   c. one wheel and axle.
   d. two of the above
2. Compound machines include all of the following except a(n)
   a. chisel.
   b. bicycle.
   c. automobile.
   d. wheelbarrow.
3. An axe is a compound machine that consists of a wedge and a(n)
   a. screw.
   b. inclined plane.
   c. first class lever.
   d. third class lever.
4. A compound machine tends to be less efficient than a simple machine because a compound machine
   a. produces more work.
   b. exerts a greater force.
   c. has more moving parts.
   d. none of the above
5. Which of the following machines has the greatest mechanical advantage?
   a. mountain bike
   b. inline skate
   c. roller skate
   d. tricycle

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. A wheel and axle is an example of a compound machine.

_____ 7. A pulley system that contains a fixed and a moveable pulley is a compound machine.

_____ 8. A single pulley is less efficient than a pulley system that consists of two or more pulleys.

_____ 9. The mechanical advantage of a compound machine is generally less than that of a simple machine.

_____ 10. Friction tends to be a bigger problem in a compound machine than in a simple machine.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Any machine that consists of at least two simple machines is called a(n) _____ machine.

12. Simple machines in a wheelbarrow are a wheel and axle and a(n) _____.

13. A fishing rod is a _____ class lever.

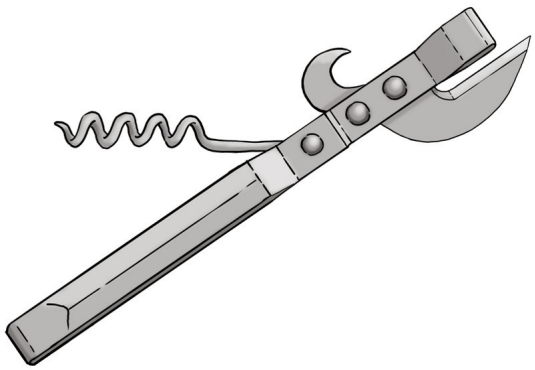
14. A fishing reel is a wheel and axle that acts as a(n) _____.

15. The mechanical advantage of a compound machine equals the _____ of the mechanical advantages of all of its component simple machines.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Identify three simple machines in the hand-held can and bottle opener pictured below. What does each simple machine do?



17. How might the efficiency of a compound machine be increased? Why would this be advantageous?

## Answer Key

1. d 2. a 3. d 4. c 5. a

6. false 7. true 8. false 9. false 10. true

11. compound 12. lever 13. third 14. pulley 15. product

16. Three simple machines in the can and bottle opener are a wedge, lever, and screw. The wedge is the blade that pierces and cuts open the lid of a can. The lever is the shaft of the can opener that allows the user to apply force to the blade. The screw is the cork screw that sticks out to the side of the can opener. It can be turned to pierce the cork in the top of a bottle so it can be pulled out of the bottle.

17. The efficiency of a compound machine might be increased by using a lubricant such as oil or grease to make moving parts slippery so there is less friction. This would be advantageous because it would allow the machine to produce more output work and less heat. It would also reduce wear on the moving parts so they should last longer.

# 16.5 Work and Machines

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. You do work whenever you
   a. apply a force of at least 1 newton to an object.
   b. move an object over a distance of at least 1 meter.
   c. move an object in the same direction that you apply force.
   d. two of the above
2. Assume that you push a 50-newton box over a distance of 2 meters. How much work have you done?
   a. 100 J
   b. 50 J
   c. 25 J
   d. 2 J
3. An example of a machine that changes the direction of the applied force is a
   a. flagpole pulley.
   b. doorknob.
   c. nutcracker.
   d. hammer.
4. What is the ideal mechanical advantage of a machine that has an input distance of 5 meters and an output distance of 10 meters?
   a. $\frac{1}{2}$
   b. 1
   c. 2
   d. 5
5. For the machine in question 4, the actual mechanical advantage must be
   a. less than $\frac{1}{2}$.
   b. greater than $\frac{1}{2}$.
   c. greater than 1.
   d. greater than 2.
6. Simple machines that have an ideal mechanical advantage greater than 1 include
   a. screws.
   b. inclined planes.
   c. wedges.
   d. all of the above
7. Which statement about compound machines is false?

a. They have a greater mechanical advantage than simple machines.
b. They may consist of hundreds of simple machines.
c. They are more efficient than simple machines.
d. They include scissors and bicycles.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. In physics, work is done only when something moves.

_____ 9. The SI unit for power is the watt.

_____ 10. A 1000-watt device does 1000 joules of work in 10 seconds.

_____ 11. Watt's invention of a powerful steam engine ended the industrial revolution.

_____ 12. No machine is 100% efficient.

_____ 13. Efficiency is calculated by dividing the output force by the input force.

_____ 14. The input force of an inclined plane is always greater than the output force.

_____ 15. The wheel and axle of a wheel and axle turn in opposite directions.

_____ 16. A screw with more threads has a shorter inclined plane.

_____ 17. A second class lever changes the direction of the applied force.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. One joule equals the amount of work done when 1 newton of force moves an object over a distance of _____-___.

19. Power is calculated by dividing _____ by time.

20. A machine that changes only the direction of force has a mechanical advantage of _____.

21. The force you apply to any machine when you use it is called the _____ force.

22. The type of simple machine that consists of an inclined place wrapped around a cylinder is the _____.

23. In a _____ class lever, the fulcrum is located between the input force and output force.

24. Simple machines that contain a wheel include the wheel and axle and the _____.

25. A wheelbarrow is a compound machine consisting of a wheel and axle and a(n) _____.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Explain how the following five terms are related: force, distance, work, time, power.

27. A broom is a type of lever that you hold with two hands. The top hand forms the fulcrum and the other hand applies the input force. Which type of lever is a broom? How does it change the input force and where is the output force applied? What is the broom's ideal mechanical advantage?

28. Assume you have invented a machine that consists of a single fixed pulley, a single moveable pulley, and a first class lever. The fulcrum of the lever is midway between the input and output points. What is the mechanical advantage of your invention? Explain your answer.

## Answer Key

1. c 2. a 3. a 4. a 5. a 6. d 7. c

8. true 9. true 10. false 11. false 12. true 13. false 14. false 15. false 16. false 17. false

18. 1 meter 19. work 20. 1 21. input 22. screw 23. first 24. pulley 25. lever

26. *Sample answer*: You do work when you use force to move an object over a distance. The amount of work equals the force you apply to the object multiplied by the distance the object moves. The amount of work you can do in a given amount of time depends on the power with which you do the work. Power can be calculated by dividing work by time. The more power you apply to an object, the more work you can do in a given time.

27. A broom is a third class lever. It decreases the input force but applies it over a greater distance. The output force is applied by the bristle end of the broom, which sweeps the floor. The broom's ideal mechanical advantage is less than 1, like all third class levers.

28. The mechanical advantage of a compound machine is the product of the mechanical advantages of the simple machines it contains. A single fixed pulley has a mechanical advantage of 1, and a single moveable pulley has a mechanical advantage of 2. A first class lever with the fulcrum midway between the input and output points has a mechanical advantage of 1. Therefore, the mechanical advantage of the compound machine you invented is $1 \times 2 \times 1 = 2$.

CHAPTER 17

# Introduction to Energy Assessments

## Chapter Outline



# 17.1 Types of Energy

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. A leaf hanging motionless on a tree has
   a. no energy.
   b. elastic energy.
   c. kinetic energy.
   d. potential energy.
2. When a moving bat hits a ball, what happens to the kinetic energy of the bat?
   a. All of it becomes potential energy.
   b. Most of it is transferred to the ball.
   c. All of it is used up and gone.
   d. Most of it changes to heat.
3. A 40-kilogram boy is running at a velocity of 3 m/s. What is his kinetic energy?
   a. 180 J
   b. 120 J
   c. 43 J
   d. 13 J
4. Lana, who weighs 400 newtons, is about to dive from a 10-meter diving board. Her gravitational potential energy is
   a. 40 J
   b. 2000 J
   c. 4000 J
   d. 40,000 J
5. Energy is converted from kinetic energy to potential energy when you
   a. ski down a hill.
   b. climb a mountain.
   c. run around a level track.
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. The atoms of matter have kinetic energy.

_____ 7. An object's velocity affects its kinetic energy more than its mass does.

_____ 8. A heavier object has less gravitational potential energy than a lighter object at the same height.

_____ 9. Compressing a spring gives it potential energy.

_____ 10. Energy conversions cannot be reversed.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ can be defined as the ability to do work.

12. The process in which energy changes form is called energy _____.

13. The energy of moving matter is known as _____ energy.

14. Energy that is stored in matter is called _____ energy.

15. Kinetic energy is directly related to velocity and _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Compare and contrast kinetic energy and potential energy.

17. Describe how energy changes on a trampoline.

## Answer Key

1. d 2. b 3. a 4. c 5. b

6. true 7. true 8. false 9. true 10. false

11. Energy 12. conversion 13. kinetic 14. potential 15. mass

16. Kinetic energy is the energy of moving objects. Anything that is moving has kinetic energy, but as soon as it stops moving it no longer has kinetic energy. Potential energy is energy that is stored in objects that are not moving. They have potential energy because of their position or shape. Objects have gravitational potential energy if they

have the potential to fall due to their position above Earth's surface. Objects have elastic potential energy if they have the property of elasticity and are stretched or compressed. This gives them the potential to spring back to their original shape.

17. When you are on a trampoline and jump up, you have kinetic energy. As you rise higher, your kinetic energy changes to potential energy. By the time you reach the very top of your jump, you have only potential energy. Then, as you fall back down to the trampoline, your potential energy changes back to kinetic energy. When you land on the trampoline, it stretches and gives you elastic potential energy. Then the elastic potential energy changes to kinetic energy as the trampoline springs back to its original shape and pushes you up into the air again.

# 17.2 Forms of Energy

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The sum of an object's kinetic and potential energy is its
   a. thermal energy.
   b. chemical energy.
   c. mechanical energy.
   d. none of the above
2. Which form of energy travels in waves through empty space?
   a. sound energy
   b. electrical energy
   c. electromagnetic energy
   d. two of the above
3. Which energy conversion occurs in a battery?
   a. electrical energy $\rightarrow$ chemical energy
   b. electromagnetic energy $\rightarrow$ light energy
   c. chemical energy $\rightarrow$ light energy
   d. chemical energy $\rightarrow$ electrical energy
4. Energy stored in the nucleus of an atom is called
   a. electromagnetic energy.
   b. electrical energy.
   c. thermal energy.
   d. nuclear energy.
5. If two objects have the same mass, which object has greater thermal energy?
   a. The object with larger atomic nuclei.
   b. The object with faster-moving atoms.
   c. The object with faster-moving electrons.
   d. The object with stronger chemical bonds.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Stars release electromagnetic energy into space.

_____ 7. The energy stored in food is chemical energy.

_____ 8. During photosynthesis, plants change thermal energy to chemical energy.

_____ 9. A stretched rubber band has mechanical energy.

_____ 10. When you plug in a lamp, electromagnetic energy is converted to light energy.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The energy released when two atomic nuclei fuse together is _____ energy.

12. _____ energy is the energy of an object that is moving or has the potential to move.

13. The kinetic energy of moving electrons is referred to as _____ energy.

14. _____ energy is the total kinetic energy of all the atoms in an object.

15. Energy that travels in waves through matter from a vibrating object is _____ energy.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Compare and contrast electromagnetic energy and sound energy.

17. Identify at least three forms of energy involved when a musician plays an electric keyboard.

## Answer Key

1. c 2. c 3. d 4. d 5. b

6. true 7. true 8. false 9. true 10. false

11. nuclear 12. Mechanical 13. electrical 14. Thermal 15. sound

16. Electromagnetic energy and sound energy are two different forms of energy. Electromagnetic energy is released by the sun and other stars. Sound energy is produced by vibrating matter. Both forms of energy travel in waves.

However, electromagnetic waves can travel through empty space, whereas sound waves can travel only through matter.

17. When a musician plays an electric keyboard, she uses chemical energy to move her fingers. When her fingers move to press down the keys, they have mechanical energy. The keyboard itself uses electrical energy and produces sound energy. Both the musician and keyboard, like all matter, have thermal energy because their atoms are constantly moving.

# 17.3 Energy Resources

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. All of the following energy resources are fossil fuels except
   a. oil.
   b. coal.
   c. biomass.
   d. natural gas.
2. Petroleum is used to make
   a. heating oil.
   b. kerosene.
   c. gasoline.
   d. all of the above
3. Which statement about uranium is true?
   a. It is nearly limitless in supply.
   b. It is a renewable energy resource.
   c. It is not as safe to use as solar energy.
   d. Using it for energy creates air pollution.
4. What is the function of a wind turbine?
   a. changing the kinetic energy of wind to electrical energy
   b. capturing wind energy and using it to pump water
   c. slowing down the wind so it causes less erosion
   d. storing the energy of wind as thermal energy
5. Geothermal energy
   a. comes from heat below Earth's surface.
   b. cannot be used to produce electricity.
   c. is only used to heat homes.
   d. is nonrenewable.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. All natural resources need to be conserved so they are not used up.

_____ 7. Most of the electricity in the U.S. is generated by burning petroleum.

_____ 8. The use of fossil fuels is a major cause of global warming.

_____ 9. Nuclear energy is a renewable energy resource.

_____ 10. Natural gas formed when the remains of swamp plants were pressed beneath layers of sediments.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Natural resources that are limited in supply and cannot be replaced except over millions of years are called _____ resources.

12. Mixtures of hydrocarbons that formed over millions of years from dead organisms are known as _____.

13. Natural resources that are limitless in supply or can be replaced quickly are called _____ resources.

14. The stored chemical energy of trees and other plants is referred to as _____ energy.

15. _____ means saving resources by using them more efficiently or not using them at all.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Outline the problems caused by the use of fossil fuels for energy.

17. How can people conserve energy resources in their daily lives? Identify and describe at least three different ways.

## Answer Key

1. c 2. d 3. c 4. a 5. a

6. false 7. false 8. true 9. false 10. false

11. nonrenewable 12. fossil fuels 13. renewable 14. biomass 15. Conservation

16. When fossil fuels are burned for energy, they release carbon dioxide, which causes global warming. They also release many pollutants and tiny particles into the air. Some of the pollutants form acid rain, which kills living things and damages materials. Some of the pollutants cause smog, which is harmful to human health. The tiny particles released when fossil fuels are burned also harm human health.

17. Answers may vary. *Sample answer*: People can conserve energy resources by driving less. For example, they can plan ahead to avoid unnecessary trips. They can carpool, walk, or take public transit instead of driving. If they must drive, they can drive energy-efficient vehicles. People can also conserve energy at home. For example, they can turn off lights and appliances when not in use, buy energy-efficient light bulbs and appliances, and turn the thermostat down in winter and up in summer.

# 17.4 Introduction to Energy

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The energy of moving objects is called
   a. motion energy.
   b. kinetic energy.
   c. potential energy.
   d. gravitational energy.
2. Which of the following objects has potential energy?
   a. a ball that is thrown into the air
   b. a bungee cord that is stretched
   c. a spring that is compressed
   d. all of the above
3. The gravitational potential energy of an object depends on its height above Earth and its
   a. air resistance.
   b. elasticity.
   c. velocity.
   d. weight.
4. Which statement about forms of energy is false?
   a. Energy is constantly changing form.
   b. There are a total of five different forms of energy.
   c. Any form of energy can change into any other form.
   d. A change in form of energy is called energy conversion.
5. Which change in energy occurs in a regular incandescent light bulb?
   a. mechanical energy $\rightarrow$ light energy
   b. electrical energy $\rightarrow$ light energy
   c. electrical energy $\rightarrow$ thermal energy
   d. two of the above
6. Petroleum formed over millions of years from the remains of dead
   a. marine organisms.
   b. giant tree ferns.
   c. swamp plants.
   d. two of the above
7. Harmful effects of using fossil fuels for energy include
   a. air pollution.

b. acid rain.
c. smog.
d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Energy is the ability to cause changes in matter.

_____ 9. An object with greater velocity always has more kinetic energy than an object with lesser velocity.

_____ 10. Energy is always conserved when it changes from one form to another.

_____ 11. An object with more mass always has more thermal energy than an object with less mass.

_____ 12. An object has mechanical energy only when it is moving.

_____ 13. Burning changes chemical energy to thermal and light energy.

_____ 14. Electrical energy is a form of potential energy.

_____ 15. Natural gas is used to make gasoline.

_____ 16. There are no drawbacks in using renewable energy resources.

_____ 17. Of all fossil fuels, coal releases the most air pollution when burned.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. Using force to move matter is the definition of _____ in physics.

19. The SI unit for work and energy is the _____.

20. An object has potential energy because of its shape or _____.

21. Energy stored in bonds between atoms is _____ energy.

22. A lightning bolt is a powerful discharge of _____ energy.

23. Radio waves are an example of _____ energy.

24. Anything people can use that comes from nature is a(n) _____.

25. Heat from below Earth's surface that can be used for energy is called _____ energy.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Describe an example of energy changing back and forth between kinetic and potential energy.

27. Describe an activity in which your body converts chemical energy to two or more different forms of energy. Identify the other forms of energy.

28. Explain why using renewable resources for energy is better for the environment than using nonrenewable resources.

## Answer Key

1. b 2. d 3. d 4. b 5. d 6. a 7. d

8. true 9. false 10. true 11. false 12. false 13. true 14. false 15. false 16. false 17. true

18. work 19. joule 20. position 21. chemical 22. electrical 23. electromagnetic 24. natural resource 25. geothermal

26. Answers may vary. *Sample answer*: An example of energy changing back and forth between kinetic and potential energy is a skateboarder on a half-pipe. At the top of the half-pipe, the skateboarder has gravitational potential energy. As the skateboarder rolls down the side of the half-pipe, her gravitational potential energy changes to kinetic energy. As she rolls up the other side of the half-pipe, her kinetic energy changes back to gravitational potential energy, and so on.

27. Answers may vary. *Sample answer*: Chemical energy in food provides energy for everything my body does, such as waving and shouting to a friend. My muscles use chemical energy to move my arm so I can wave. When my arm moves, it has mechanical energy. When I shout, I use chemical energy to make vibrations that travel in waves through matter. The waves carry sound energy.

28. Using renewable resources for energy is better for the environment than using nonrenewable resources because the use of nonrenewable resources creates major environmental problems. For example, the burning of fossil fuels releases carbon dioxide into the air, and this contributes to global warming. It also releases other air pollutants. Some of these pollutants form smog, which harms human health, or acid rain, which harms organisms and materials. Using nuclear energy, another nonrenewable energy resource, creates dangerous radioactive wastes and the risk of accidents that release harmful radiation. Both sources of radiation may contaminate the environment and harm people and other living things. Using renewable resources, in contrast, generally does not harm the environment or at least cause as much widespread harm as the use of nonrenewable resources does.

CHAPTER 18

# Thermal Energy Assessments

## Chapter Outline



# 18.1 Temperature and Heat

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. What happens to water when you heat it?
   a. The particles of the water gain kinetic energy.
   b. The thermal energy of the water increases.
   c. The temperature of the water rises.
   d. all of the above
2. What causes the liquid in a thermometer to rise?
   a. The liquid expands.
   b. The liquid turns to a gas.
   c. The liquid increases in mass.
   d. The liquid has greater specific heat.
3. When heat is transferred between objects of different temperatures, what is the end result?
   a. Both objects have a higher temperature.
   b. Both objects have a lower temperature.
   c. Both objects have the same temperature.
   d. The difference in temperature is greater.
4. Why does the sand on a beach get so much warmer than the water on a sunny day?
   a. The particles of sand are smaller.
   b. The sand has higher specific heat.
   c. The water has less thermal energy.
   d. The water has greater specific heat.
5. Specific heat is measured in
   a. grams.
   b. degrees.
   c. joules.
   d. newtons.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. The particles of all matter are in constant random motion.

_____ 7. Objects with the same temperature always have the same total kinetic energy.

_____ 8. A thermometer measures temperature relative to two reference temperatures.

_____ 9. Heat is always transferred from a larger object to a smaller object.

_____ 10. Differences in the specific heat of land and water affect climate.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The total kinetic energy of the particles of an object is the object's _____.

12. The average kinetic energy of the particles of an object is the object's _____.

13. The transfer of thermal energy between objects with different temperatures is called _____.

14. _____ is the amount of energy needed to raise the temperature of 1 gram of a substance by 1 °C.

15. The thermal energy of an object depends on its temperature and its _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain how a thermometer works.

17. Compare and contrast thermal energy and temperature.

## Answer Key

1. d 2. a 3. c 4. d 5. c

6. true 7. false 8. true 9. false 10. true

11. thermal energy 12. temperature 13. heat 14. Specific heat 15. mass

16. Particles of liquid in the glass tube of a thermometer have greater energy when they are warmer, so they move more and spread apart. This causes the liquid to expand and rise higher in the tube, giving a higher temperature reading.

17. Thermal energy and temperature are both measures of the kinetic energy of particles of matter. However, thermal energy is the total kinetic energy of all the particles in an object, whereas temperature is the average kinetic energy of the particles in an object. If two objects have the same temperature, the object with more particles (greater mass) has greater thermal energy than the object with fewer particles (less mass).

# 18.2 Transfer of Thermal Energy

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Conduction is usually slowest in
   a. gases.
   b. solids.
   c. liquids.
   d. flames.
2. Which of the following materials is a thermal insulator?
   a. plastic
   b. iron
   c. copper
   d. steel
3. In which substance can thermal energy be transferred by convection?
   a. air
   b. sand
   c. wood
   d. two of the above
4. Thermal energy is transferred through the ocean by
   a. currents.
   b. waves.
   c. winds.
   d. tides.
5. Matter is not needed for the transfer of thermal energy by
   a. conduction.
   b. convection.
   c. radiation.
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Conduction occurs when particles of matter flow.

_____ 7. Insulation can keep a house cool on a hot day.

_____ 8. Thermal energy is always transferred from cooler to warmer objects.

_____ 9. Land and sea breezes are examples of convection currents.

_____ 10. Only hot objects radiate thermal energy.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The transfer of thermal energy by waves that can travel through space is called _____.

12. A material that is good at conducting thermal energy is referred to as a thermal _____.

13. The transfer of thermal energy by particles moving through a fluid is known as _____.

14. The flow of particles in a fluid due to differences in temperature and density is called a(n) _____.

15. _____ is the transfer of thermal energy between particles of matter that are touching.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Compare and contrast conduction and convection.

17. Explain how energy from the sun travels to Earth and warms it.

## Answer Key

1. a 2. a 3. a 4. a 5. c

6. false 7. true 8. false 9. true 10. false

11. radiation 12. conductor 13. convection 14. convection current 15. Conduction

16. Both conduction and convection are ways in which thermal energy is transferred through matter. Conduction is the transfer of thermal energy between particles of matter that are touching. It occurs when the particles collide. Convection is the transfer of thermal energy by particles moving through a fluid. The particles transfer thermal

energy as they move. Conduction works better in liquids and certain solids but does not work well in gases because particles of gases are farther apart and have fewer collisions. Convection works only in liquids and gases (fluids) because their particles can move apart from one another and flow.

17. Energy from the sun travels to Earth by radiation. Radiation is the transfer of energy by waves that can travel through empty space. When the waves of energy reach Earth from the sun, they transfer energy to Earth's surface, causing it to warm up.

# 18.3 Using Thermal Energy

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. What happens to hot water as it moves through a home's hot-water heating system?
   a. It transfers thermal energy to the rooms of the house.
   b. It cools down and returns to the boiler.
   c. It turns to steam, which runs the fan.
   d. two of the above
2. In a warm-air heating system, cold air in each room
   a. enters an intake vent near the ceiling.
   b. blows out of a vent and across the room.
   c. leaves the house through the chimney.
   d. transfers thermal energy to the furnace.
3. What happens when the refrigerant of a cooling system absorbs thermal energy?
   a. It melts.
   b. It thaws.
   c. It condenses.
   d. It evaporates.
4. How are internal and external combustion engines similar?
   a. Both burn fuel in a cylinder.
   b. Both produce thermal energy.
   c. Both have a piston that moves in a cylinder.
   d. two of the above
5. In a functioning combustion engine, the piston has
   a. kinetic energy.
   b. electrical energy.
   c. chemical energy.
   d. thermal energy.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. The purpose of a radiator in a heating system is to produce thermal energy.

_____ 7. Warm air moves through the ducts of heating system because of gravity.

_____ 8. The transfer of thermal energy can be used to keep things cool.

_____ 9. Thermal energy naturally moves from a warmer area to a cooler area.

_____ 10. The piston of a combustion engine moves because the crankshaft turns.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A(n) _____ heating system includes a boiler, pipes, and radiators.

12. A(n) _____ is a device that controls a heating system.

13. A(n) _____ combustion engine burns fuel inside the engine.

14. The type of heating system that includes a furnace is a(n) _____ heating system.

15. The substance that transfers thermal energy in a cooling system is called a(n) _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Compare and contrast hot-water and warm-air heating systems.

17. Outline how an internal combustion engine works.

## Answer Key

1. d 2. a 3. d 4. d 5. a

6. false 7. false 8. true 9. true 10. false

11. hot-water 12. thermostat 13. internal 14. warm-air 15. refrigerant

16. Both hot-water and warm-air heating systems burn fuel to produce thermal energy and then circulate the thermal energy throughout the house. In a hot-water system, fuel is burned in a boiler that uses the thermal energy to heat water. The hot water circulates through a system of pipes and radiators, from which it transfers thermal energy into

the air of the rooms of the house. In a warm-air system, fuel is burned in a furnace that uses the thermal energy to heat air. The warm air circulates through a system of ducts and is blown into rooms through vents. In both systems, cool water or air is returned to the boiler or furnace, reheated, and recycled.

17. In an internal combustion engine, a mixture of fuel and air is pulled into a cylinder through a valve, which then closes. The piston in the cylinder is pushed upward, compressing the fuel-air mixture in the closed cylinder. The mixture is now under a lot of pressure and very warm. A spark from a spark plug is used to ignite the fuel-air mixture, causing it to burn explosively within the confined space of the closed cylinder. The pressure of the hot gases from combustion forces the piston downward. When the piston moves up again, it forces the exhaust gases of combustion out of the cylinder through another valve. Then the process repeats.

# 18.4 Thermal Energy

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. If you place a piece of iron and a piece of wood in the sun, the iron heats up more quickly because it has
   a. lower specific heat.
   b. particles that move more slowly.
   c. particles with less density.
   d. less thermal energy.
2. What does a thermometer measure?
   a. average kinetic energy
   b. thermal energy
   c. specific heat
   d. heat
3. Thermal energy is transferred between objects when they have
   a. the same mass.
   b. different masses.
   c. different temperatures.
   d. the same total kinetic energy.
4. The transfer of thermal energy between particles of matter that are touching is called
   a. radiation.
   b. insulation.
   c. convection.
   d. conduction.
5. Convection currents occur because of differences in
   a. density.
   b. temperature.
   c. state of matter.
   d. two of the above
6. What happens to warm air as it moves through a home's warm-air heating system?
   a. It blows out of vents into rooms of the house.
   b. It flows through pipes and radiators in each room.
   c. It produces thermal energy that heats the house.
   d. It transfers thermal energy to the furnace.
7. The refrigerant in a cooling system releases its thermal energy when it
   a. evaporates.

b. condenses.
c. freezes.
d. melts.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. All matter has thermal energy.

_____ 9. Temperature is a measure of heat.

_____ 10. Heat is the total thermal energy of an object.

_____ 11. Water has higher specific heat than sand.

_____ 12. Convection is the transfer of thermal energy by waves.

_____ 13. Convection currents in the atmosphere create wind.

_____ 14. All solids are good conductors of thermal energy.

_____ 15. A furnace is controlled by a device called a thermometer.

_____ 16. Warm-air vents in a heating system are placed near the floor.

_____ 17. Both internal and external combustion engines contain a cylinder and piston.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. Temperature is defined as the _____ kinetic energy of the particles of an object.

19. A substance with higher specific heat warms up _____ slowly than a substance with lower specific heat.

20. A thermometer measures temperature relative to the freezing and boiling points of _____.

21. Thermal energy moves in currents through the atmosphere by the process of _____.

22. Fluffy home insulation and down feathers are good thermal insulators because they trap _____.

23. Thermal energy can travel through empty space only by the process of _____.

24. Thermal energy is carried throughout a hot-water heating system by _____.

25. Cooling systems include air conditioners and _____.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Explain why a cool boulder in the woods is likely to have greater thermal energy than a hot pebble on the beach.

27. Assume that a room is heated by a single radiator. Explain how thermal energy in the radiator is transferred to the air throughout the room.

28. Explain how a refrigerator transfers thermal energy in a direction opposite to the normal direction of heat flow.

## Answer Key

1. a 2. a 3. c 4. d 5. d 6. a 7. b

8. true 9. false 10. false 11. true 12. false 13. true 14. false 15. false 16. true 17. true

18. average 19. more 20. water 21. convection 22. air 23. radiation 24. water 25. refrigerators

26. Thermal energy is the total kinetic energy of the particles of an object. It depends on how fast the particles of the object are moving as well as the mass of the object, because an object with greater mass has more particles. A cool boulder has slower moving particles than a hot pebble. However, the boulder has many more particles than the pebble. Therefore, the boulder is likely to have greater thermal energy than the pebble.

27. Thermal energy in the radiator is transferred to the air throughout the room by conduction, radiation, and convection. The warm radiator transfers thermal energy to the air particles that it touches directly by the process of conduction. The radiator also transfers thermal energy by waves into the surrounding air through the process of radiation. As the air near the radiator becomes warmer, the air particles move faster, spread apart, and become less dense. This starts convection currents that transfer thermal energy throughout the rest of the air in the room.

28. Thermal energy is normally transferred from a warmer to a cooler area. A refrigerator transfers thermal energy in the opposite direction—from the cool air in the refrigerator to the warm air in the room—by doing work. Using energy, typically from electricity, a refrigerator circulates a substance with a low boiling point, called a refrigerant. When the refrigerant is in the liquid state and very cold, it absorbs thermal energy from the cool air in the refrigerator. The thermal energy causes the refrigerant to get warm enough to evaporate. The gaseous refrigerant is compressed, which raises its temperature higher. The hot gaseous refrigerant then transfers its thermal energy to condenser coils, from which the thermal energy is transferred to the room. By losing thermal energy, the refrigerant cools down and condenses back to the liquid state. Then the cycle repeats.

# CHAPTER 19 Waves Assessments

## Chapter Outline



# 19.1 Characteristics of Waves

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. You can start a surface wave by
   a. pushing and pulling on a spring.
   b. shaking a rope up and down.
   c. dropping a pebble in a pond.
   d. all of the above
2. What is required for a mechanical wave to occur?
   a. a disturbance in matter
   b. a source of energy
   c. particles of matter
   d. all of the above
3. The parts of a longitudinal wave where particles of matter are spread farthest apart are called
   a. crests.
   b. vibrations.
   c. rarefactions.
   d. compressions.
4. The lowest parts of a transverse wave is are known as
   a. valleys.
   b. troughs.
   c. bottoms.
   d. media.
5. What is an S wave?
   a. any transverse wave
   b. a type of longitudinal wave
   c. a wave generated by an earthquake
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Ocean waves travel deep below the surface of the water.

_____ 7. The medium of a mechanical wave must be a solid or liquid.

_____ 8. In a surface wave, particles of matter move in a circular motion.

_____ 9. A primary (P) wave is a longitudinal wave.

_____ 10. All waves must travel through matter.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A(n) _____ wave is a disturbance in matter that transfers energy from place to place.

12. The matter through which a mechanical wave travels is called the _____.

13. In a(n) _____ wave, particles of the medium vibrate in the same direction that the wave travels.

14. In a(n) _____ wave, particles of the medium vibrate at right angles to the direction that the wave travels.

15. A combined transverse and longitudinal wave is called a(n) _____ wave.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Compare and contrast transverse and longitudinal waves.

17. Explain how energy travels in a mechanical wave.

## Answer Key

1. c 2. d 3. c 4. b 5. c

6. false 7. false 8. true 9. true 10. false

11. mechanical 12. medium 13. longitudinal 14. transverse 15. surface

16. Both transverse and longitudinal waves are mechanical waves, which are waves that need matter—called the medium—in order to travel from place to place. Like other mechanical waves, transverse and longitudinal waves begin when a source of energy causes a disturbance in matter. The two types of waves differ in the direction that

particles of the medium move when the energy of the wave passes through them. In a transverse waves, particles of the medium vibrate at right angles to the direction that the wave travels. In a longitudinal wave, particles of the medium vibrate in the same direction that the wave travels.

17. In a mechanical wave, energy travels through matter, but the particles of matter do not actually travel along with the wave. Only the energy travels. The particles of matter just vibrate in place. As the particles vibrate, they pass the energy of the disturbance to the particles next to them, which pass the energy to the particles next to them, and so on.

# 19.2 Measuring Waves

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. In a longitudinal wave, amplitude is a measure of
   a. how many waves pass a fixed point each second.
   b. how close together particles of the medium become.
   c. how quickly the wave travels a given distance.
   d. how far apart adjacent compressions are.
2. If two waves have the same amplitude, the wave with more energy is the wave with the
   a. shorter wavelength.
   b. lower frequency.
   c. denser medium.
   d. slower speed.
3. If two waves have the same speed, the wave with a higher frequency must have a
   a. shorter wavelength.
   b. longer wavelength.
   c. greater amplitude.
   d. two of the above
4. Wave speed is a product of
   a. wavelength and frequency.
   b. wavelength and amplitude.
   c. frequency and amplitude.
   d. none of the above
5. What is the frequency of a wave that has a wavelength of 2 m and a speed of 2 m/s?
   a. 4 Hz
   b. 2 Hz
   c. 1 Hz
   d. $\frac{1}{2}$ Hz

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. One measure of wave size is wave frequency.

_____ 7. The resting position of a transverse wave is called a trough.

_____ 8. If you know only a wave's amplitude and wavelength, you can calculate its speed.

_____ 9. Wave speed and wavelength have an inverse relationship.

_____ 10. A tsunami is an ocean wave with an unusually great amplitude.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The distance between two adjacent troughs of a transverse wave is the _____.

12. The number of waves that pass a fixed point in a given amount of time is the _____ of the waves.

13. How far a wave travels in a given amount of time is its _____.

14. The SI unit for wave frequency is the _____.

15. The maximum distance particles of a medium move from their resting position is the _____ of the wave.

**Short Answer**

*Answer the following questions in complete sentences.*

16. How is wave speed related to wavelength and wave frequency?

17. Which wave measures reflect how much energy a wave has?

## Answer Key

1. b 2. a 3. a 4. a 5. c

6. false 7. false 8. false 9. false 10. true

11. wavelength 12. frequency 13. speed 14. hertz (Hz) 15. amplitude

16. Wave speed is directly related to wavelength and wave frequency because wave speed equals wavelength multiplied by wave frequency. Increasing either the wavelength or frequency of a wave (assuming the other value does not change) increases the wave's speed.

17. The wave measures of amplitude, wavelength, and frequency all reflect how much energy a wave has. A wave with a greater amplitude, shorter wavelength, or higher frequency has more energy.

# 19.3 Wave Interactions and Interference

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. An echo occurs because of wave
   a. interference.
   b. diffraction.
   c. refraction.
   d. reflection.
2. If a wave strikes a barrier at a 45° angle, what is the angle of reflection?
   a. 180°
   b. 120°
   c. 90°
   d. 45°
3. Light is refracted when it
   a. strikes a barrier it cannot pass through.
   b. spreads around an obstacle such as a wall.
   c. passes from air to water at an angle.
   d. interferes with other waves.
4. What happens when a wave passes around a barrier that is shorter than its wavelength?
   a. The wave has a large angle of incidence.
   b. The wave spreads out around the barrier.
   c. The wave is refracted.
   d. none of the above
5. Constructive interference occurs when two waves pass through each other and the
   a. crests of both waves cancel each other out.
   b. crests of both waves have a smaller amplitude.
   c. crests of one wave overlap crests of the other wave.
   d. crests of one wave cancel out troughs of the other wave.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Reflected waves have the same speed as the original waves before they were reflected.

_____ 7. Diffraction occurs because waves travel at different speeds in different media.

_____ 8. You can hear sounds around the corner of a building because the sound waves are refracted.

_____ 9. Destructive interference decreases the amplitude of waves.

_____ 10. A standing wave forms when a wave is refracted.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Waves may bend as they enter a new medium at an angle because of _____.

12. The spreading out of waves around an obstacle is referred to as _____.

13. The bouncing back of waves from a barrier is known as _____.

14. The angle at which waves bounce back from a barrier is called the angle of _____.

15. Any interaction of waves with other waves is called wave _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Compare and contrast constructive and destructive interference.

17. Explain what a standing wave is and when it occurs.

## Answer Key

1. d 2. d 3. c 4. b 5. c

6. true 7. false 8. false 9. true 10. false

11. refraction 12. diffraction 13. reflection 14. reflection 15. interference

16. Both constructive and destructive interference occur when two waves are traveling in opposite directions and pass through each other. Constructive interference occurs when the crests of one wave overlap the crests of the other wave. This increases the amplitude of the waves. Destructive interference occurs when the crests of one wave overlap the troughs of the other wave. This decreases the amplitude of the waves.

17. A standing wave is a wave that appears to be standing still. It occurs when a wave is reflected straight back from an obstacle and the reflected wave interferes with the original wave. The wave appears to be standing still because of a combination of constructive and destructive interference between the wave and its reflected wave.

# 19.4 Waves

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. How are transverse and longitudinal waves similar?
    a. Both require a medium.
    b. Both are mechanical waves.
    c. Both transfer energy by vibrating particles.
    d. all of the above
2. The compressions of a longitudinal wave are like the
    a. rarefactions of a transverse wave.
    b. low points of a transverse wave.
    c. troughs of a transverse wave.
    d. crests of a transverse wave.
3. What is a primary wave?
    a. any longitudinal wave
    b. a type of transverse wave
    c. a wave that travels through underground rocks.
    d. two of the above
4. If two waves have the same frequency and speed, they must also have the same
    a. height.
    b. medium.
    c. amplitude.
    d. wavelength.
5. When you make waves in a rope by shaking one end up and down, you can increase the amplitude of the waves by moving the rope
    a. more slowly.
    b. more quickly.
    c. over a longer distance.
    d. over a shorter distance.
6. Waves interact with matter in all of the following ways except
    a. refraction.
    b. reflection.
    c. diffraction.
    d. interference.
7. When a wave is reflected, the angle of reflection equals the

a. wavelength.
b. wave frequency.
c. wave amplitude.
d. angle of incidence.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Mechanical waves include ocean waves and electromagnetic waves.

_____ 9. You can start a longitudinal wave by shaking a rope up and down.

_____ 10. An earthquake generates both transverse and longitudinal waves.

_____ 11. Ocean waves carry particles of water over long distances.

_____ 12. Wave amplitude is the only measure of wave size.

_____ 13. A lower-frequency wave has less energy than a higher-frequency wave of the same amplitude.

_____ 14. A wave is likely to slow down when it passes from a gas to a solid.

_____ 15. Constructive interference decreases the amplitude of waves.

_____ 16. When a wave is reflected, its frequency increases.

_____ 17. A wave diffracts when it enters a new medium at an angle.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. Any wave that requires matter in order to transfer energy is called a(n) _____ wave.

19. The parts of a longitudinal wave where particles of the medium are farthest apart are called _____.

20. A(n) _____ wave travels along the surface of a medium.

21. Wave speed equals wave frequency multiplied by _____.

22. The _____ of a longitudinal wave is where particles of the medium are neither compressed nor rarefied.

23. A wave has a frequency of 1 hertz if one wave passes a fixed point each _____.

24. _____ interference occurs when the crests of two interfering waves overlap.

25. A standing wave occurs because of wave _____ between a wave and its reflected wave.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Give an example of a surface wave, and describe how particles of the medium move when the energy of a surface wave passes through them.

27. How does the state of the medium of a wave affect the wave's speed?

28. Explain how refraction of a wave occurs.

## Answer Key

1. d 2. d 3. c 4. d 5. c 6. d 7. d

8. false 9. false 10. true 11. false 12. false 13. true 14. false 15. false 16. false 17. false

18. mechanical 19. rarefactions 20. surface 21. wavelength 22. resting position 23. second 24. Constructive 25. interference

26. *Sample answer*: An example of a surface wave is an ocean wave. When the energy of a surface wave passes through particles of a medium, the particles vibrate up and down and also back and forth, giving them an overall circular motion.

27. Generally, waves travel most quickly through solid media and most slowly through media that are gases. That's because particles are closest together in solids and farthest apart in gases. When particles are farther apart, it takes longer for the energy of the wave to pass from particle to particle.

28. Refraction of a wave is the apparent bending of a wave when it passes into a new medium at an angle. It occurs because the speed of the wave is different in the new medium. As a result, the wave slows down or speeds up as it enters the new medium and changes direction.

# CHAPTER 20 Sound Assessments

## Chapter Outline



# 20.1 Characteristics of Sound

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Sound waves travel most rapidly through
   a. air.
   b. water.
   c. glass.
   d. aluminum.
2. Assume that a sound has an intensity of 50 decibels. A sound one-tenth as intense as this sound would have an intensity of
   a. 5 decibels.
   b. 10 decibels.
   c. 40 decibels.
   d. 49 decibels.
3. Which property of sound is affected by distance from the sound source?
   a. pitch
   b. frequency
   c. intensity
   d. wavelength
4. The pitch of a sound depends on the sound wave's
   a. medium.
   b. frequency.
   c. speed.
   d. amplitude.
5. Which properties of the medium affect the speed of sound waves?
   a. state
   b. density
   c. temperature
   d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Sound waves are longitudinal waves.

_____ 7. Human beings can hear higher sounds than any other species.

_____ 8. Sound waves travel more quickly in air than in most other media.

_____ 9. The frequency of sound waves is measured in decibels.

_____ 10. Sound always travels more slowly than light.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. _____ is the transfer of energy from a vibrating object in waves that travel through matter.

12. Sound intensity is measured in a unit called the _____.

13. How high or low a sound seems to a listener is its _____.

14. Sound with a frequency above 20,000 hertz is known as _____.

15. Sound that is too low for human beings to hear is called _____.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

16. How is loudness of sound related to the energy of sound waves?

17. Describe and explain the Doppler effect.

## Answer Key

1. d 2. c 3. c 4. b 5. d

6. true 7. false 8. false 9. false 10. true

11. Sound 12. decibel (dB) 13. pitch 14. ultrasound 15. infrasound

16. Intensity is a measure of the energy of sound waves, and sounds with greater intensity are louder. Intensity is greater when sound waves have greater amplitude or are closer to the sound source.

17. The Doppler effect is a change in the frequency of sound waves (and pitch of sound) when the source of the sound waves is moving relative to the listener. As the sound source approaches the listener, the sound waves become crowded together between the sound source and listener. This makes the frequency of the sound waves higher, so the pitch of the sound is higher. As the sound source moves away from the listener, the sound waves become spread out between the sound source and listener. This makes the frequency of the waves lower, so the pitch of the sound is lower.

# 20.2 Hearing Sound

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which choice shows the correct sequence in which sound waves travel through the ear?
   a. ear canal → eardrum → hammer
   b. anvil → oval window → ear canal
   c. stirrup → pinna → eardrum
   d. eardrum → ear canal → cochlea
2. In which structure of the ear are sound waves changed to nerve impulses?
   a. eardrum
   b. stirrup
   c. oval window
   d. cochlea
3. Which structures are found in the outer ear?
   a. anvil, pinna, eardrum
   b. pinna, ear canal, eardrum
   c. ear canal, cochlea, stirrup
   d. hammer, pinna, ear canal
4. Functions of the ossicles include
   a. amplifying sound waves.
   b. transferring sound waves.
   c. catching sound waves.
   d. two of the above
5. Which decibel level of sound has the longest permissible exposure time?
   a. 85 dB
   b. 100 dB
   c. 106 dB
   d. 115 dB

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. The brain plays an essential role in hearing.

_____ 7. The most common cause of hearing loss is damage to the eardrum.

_____ 8. The role of hearing protectors is to keep foreign objects out of the ears.

_____ 9. The eardrum is the first structure of the ear to vibrate when sound waves strike it.

_____ 10. Waves in cochlear fluid bend the hair-like projections of hair cells.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Sound waves travel through the _____ to reach the eardrum.

12. The three tiny bones of the middle ear are called _____.

13. The _____ is a fluid-filled structure in the inner ear.

14. The _____ is a thin membrane that vibrates when sound waves strike it.

15. The only part of the ear that extends outward from the head is the _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. If there were no middle ear and vibrations passed directly from the eardrum to the inner ear, how do you think hearing would be affected? (*Hint*: How does the middle ear change sound waves?)

17. Explain the role of hair cells in hearing.

## Answer Key

1. a 2. d 3. b 4. d 5. a

6. true 7. false 8. false 9. true 10. true

11. ear canal 12. ossicles 13. cochlea 14. eardrum 15. pinna

16. The three tiny bones of the middle ear act together as a lever and amplify sound waves as they transfer the waves from the eardrum to the inner ear. When sound waves are amplified, they have greater intensity and sound louder.

Therefore, if there were no middle ear, sound waves would not be amplified and the sounds we hear would not be as loud.

17. The role of hair cells in hearing is to change sound waves to nerve impulses. Hair cells line the inside of the cochlea. They are called hair cells because they have tiny, hair-like projections. When sound waves create waves in the fluid inside the cochlea, the waves bend the "hairs" on the hair cells. When this occurs, the hair cells generate nerve impulses that travel to the brain, which perceives the sound.

# 20.3 Using Sound

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Resonance is used in musical instruments to increase the
    a. frequency of sound waves.
    b. amplitude of sound waves.
    c. wavelength of sound waves.
    d. two of the above
2. You can raise the pitch of the sound produced by a violin string by
    a. shortening the part of the string that vibrates.
    b. plucking instead of bowing the string.
    c. applying more pressure with the bow.
    d. none of the above
3. Uses of ultrasound include
    a. creating images of organs inside the body.
    b. making music with musical instruments.
    c. communicating with the human voice.
    d. all of the above
4. What does sonar stand for?
    a. source of naval resistance
    b. source of noise and resonance
    c. sound navigation and ranging
    d. submarine navigation and resolution
5. Increasing the amplitude of sound waves produced by a musical instrument makes the sound
    a. lower.
    b. higher.
    c. softer.
    d. louder.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. All musical instruments create sound by causing a reed to vibrate.

_____ 7. Smaller drums produce higher-frequency sound waves than larger drums.

_____ 8. Ultrasound has frequencies lower than 20 hertz.

_____ 9. Ultrasonography has been used to determine the depth of the ocean.

_____ 10. Animals that use echolocation include bats and whales.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The vibration of an object in response to sound waves of a certain frequency is called _____.

12. _____ is the use of reflected sound waves by certain animals to locate objects they cannot see.

13. A(n) _____ device uses of reflected sound waves to locate underwater objects.

14. The category of musical instruments that includes the saxophone is _____ instruments.

15. Any sound that is too high in pitch for human beings to hear is known as _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. When you press down on the keys of a piano, tiny hammers strike metal strings inside the piano. This causes the strings to vibrate and make sounds. In which basic category of musical instruments would you place a piano? Justify your answer.

17. A certain animal species lives in open areas of land and is active during daylight hours. Would you expect this species to have the ability to use echolocation to find prey? Why or why not?

## Answer Key

1. b 2. a 3. a 4. c 5. d

6. false 7. true 8. false 9. false 10. true

11. resonance 12. Echolocation 13. sonar 14. wind 15. ultrasound

16. *Sample answer*: I would classify the piano as either a string instrument or a percussion instrument. The piano has strings that are made to vibrate and produce sound, like a violin or guitar, both of which are string instruments. On the other hand, the strings are struck by hammers, which is how percussion instruments like drums make sounds.

17. *Sample answer*: I would not expect this animal species to have the ability to use echolocation to find prey. Echolocation is the use of reflected ultrasound waves to identify the locations of objects that cannot be seen. Animals that use echolocation include bats, which are active during the night, and whales and dolphins, both of which live under the water in the ocean. All of these species live under conditions in which vision is not as useful as echolocation. A species that lives out in the open and is active during daylight hours would not need to use echolocation to find prey because they would be able to use vision to see their prey.

# 20.4 Sound

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. A 60-decibel sound is 1000 times louder than a sound of
   a. 20 decibels.
   b. 30 decibels.
   c. 40 decibels.
   d. 50 decibels.
2. In his ticking clock experiment, Robert Boyle demonstrated that
   a. sounds more intense than 130 decibels can damage hearing.
   b. sound waves cannot travel through empty space.
   c. sound waves travel at a speed of 3430 m/s.
   d. sound waves cannot travel through water.
3. If you increase the frequency of sound waves, how does a listener perceive the change?
   a. The sound is higher.
   b. The sound is lower.
   c. The sound is louder.
   d. The sound is softer.
4. The most common cause of permanent hearing loss is
   a. broken bones in the middle ear.
   b. blockage of the ear canal.
   c. puncture of the eardrum.
   d. damage to hair cells.
5. Electronic hearing protectors decrease the amplitude of loud sounds by
   a. causing destructive interference.
   b. keeping sound waves out of the ears.
   c. preventing the eardrum from vibrating.
   d. decreasing the frequency of sound waves.
6. All of the following instruments make a column of air vibrate except a
   a. tuba.
   b. drum.
   c. clarinet.
   d. saxophone.
7. Echolocation is based on the
   a. refraction of sound waves.

b. reflection of sound waves.
c. diffraction of sound waves.
d. interference of sound waves.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. The speed of sound is constant.

_____ 9. You would experience the Doppler effect if you rode in a police car with its siren on.

_____ 10. Sound waves transfer particles of the medium to the listener's ears.

_____ 11. The main function of the outer ear is to change sound waves to nerve impulses.

_____ 12. Ossicles are tiny bones that transfer sound waves to the inner ear.

_____ 13. Only construction workers need to wear hearing protectors.

_____ 14. The eardrum is located in the outer ear.

_____ 15. Sonar could be used to find the location of a sunken ship.

_____ 16. Most musical instruments have a way to change the frequency of sound waves.

_____ 17. Ultrasonography can be used to create images only of bones and teeth.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. Any sound with a frequency below 20 hertz is called _____.

19. Sound waves are mechanical waves because they must travel through a(n) _____.

20. The _____ of sound to a listener depends on the intensity of the sound waves.

21. Sound waves travel _____ slowly through warm air than cool air.

22. The _____ of sound is measured in decibels.

23. The part of the ear that amplifies sound waves is the _____ ear.

24. The category of musical instruments that includes the violin is _____ instruments.

25. Most musical instruments use _____ to amplify sound waves.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Discuss how the speed of sound is related to the medium of the sound waves.

27. Explain how the ear and brain work together to allow us to hear sounds.

28. Why does resonance in a musical instrument make it sound louder?

## Answer Key

1. b 2. b 3. a 4. d 5. a 6. b 7. b

8. false 9. false 10. false 11. false 12. true 13. false 14. true 15. true 16. true 17. false

18. infrasound 19. medium 20. loudness 21. less 22. intensity 23. middle 24. string 25. resonance

26. The speed of sound depends on the medium of the sound waves. For example, sound travels faster through aluminum than it does through glass, and faster through glass than through water. Generally, sound waves travel fastest through solids and slowest through gases. The speed of sound also depends on the temperature of the medium. For a given medium, sound has a slower speed when the medium has a lower temperature.

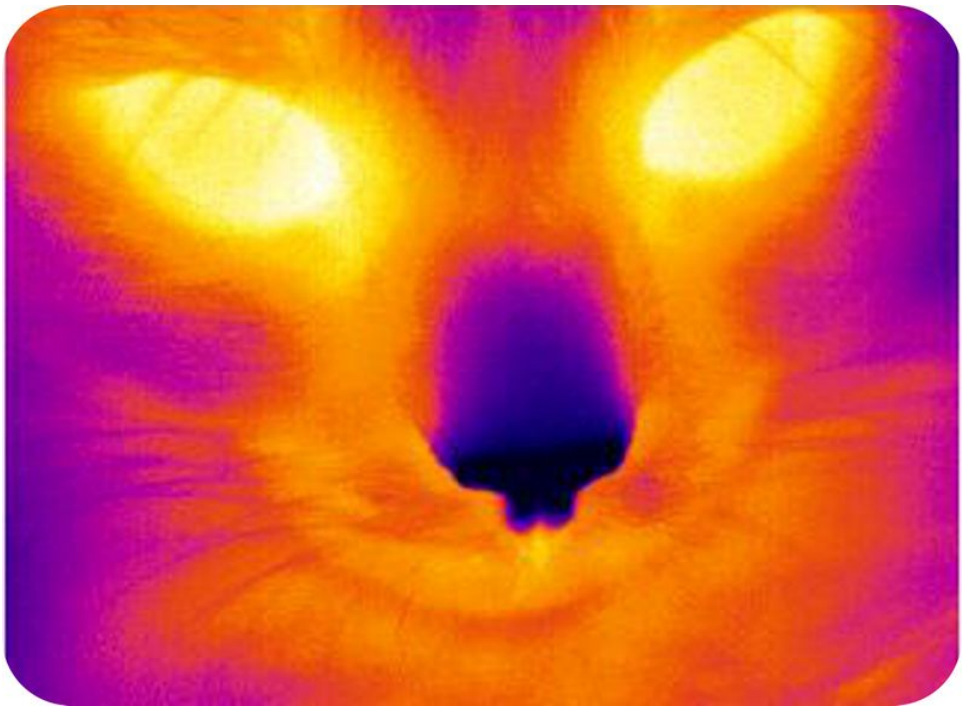
27. The structures of the ear gather and amplify sound waves and change their energy to electrical signals called nerve impulses. The electrical signals travel to the brain through nerves, and the brain interprets the signals as sounds.

28. Resonance occurs when an object vibrates in response to sound waves of a certain frequency. In a musical instrument, resonance causes constructive interference of sound waves, which increases their amplitude. Sound waves with higher amplitude produce sounds that are louder to the listener.

# CHAPTER 21 Electromagnetic Radiation Assessments

## Chapter Outline





# 21.1 Electromagnetic Waves

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. All of the following are examples of electromagnetic waves except
   a. sound waves.
   b. microwaves.
   c. gamma rays.
   d. infrared light.
2. An electromagnetic wave begins when a(n)
   a. atom loses an electron.
   b. magnet is connected to a battery.
   c. charged particle vibrates.
   d. electron is magnetized.
3. Which of the following waves does not require a medium?
   a. ocean waves
   b. earthquake waves
   c. sound waves
   d. radio waves
4. Most of the electromagnetic radiation on Earth comes from
   a. the sun.
   b. radio towers.
   c. X ray machines.
   d. microwave ovens.
5. Uses of electromagnetic radiation include
   a. cooking.
   b. communications.
   c. medicine.
   d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. The wave-particle theory explains the difference between electromagnetic and mechanical waves.

_____ 7. A vibrating electric field generates a charged particle.

_____ 8. All electromagnetic radiation is dangerous except for light.

_____ 9. Electromagnetic radiation provides the energy that plants need for photosynthesis.

_____ 10. An electromagnetic wave gains energy as it travels across space.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The invisible area of force surrounding a charged particle is a(n) _____.

12. A(n) _____ is a packet of electromagnetic energy.

13. Electromagnetic radiation behaves as both a wave and as a(n) _____.

14. A(n) _____ wave consists of vibrating electric and magnetic fields.

15. The transfer of energy by waves that can travel across space is called _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Compare and contrast radio waves and waves in a rope.

17. How did Albert Einstein explain the behavior of electromagnetic radiation?

## Answer Key

1. a 2. c 3. d 4. a 5. d

6. false 7. false 8. false 9. true 10. false

11. electric field 12. photon 13. particle 14. electromagnetic 15. electromagnetic radiation

16. Like all waves, both radio waves and waves in a rope transfer energy. Both are also transverse waves, in which vibrations occur at right angles to the direction that the waves travel. However, radio waves are electromagnetic waves, which do not need a medium, whereas waves in a rope are mechanical waves, which do need a medium.

17. Albert Einstein explained why electromagnetic radiation behaves like a wave most of the time but like a particle some of the time. According to his wave-particle theory, when an electron returns to a lower energy level, it gives off energy in a stream of tiny "packets" that are similar to particles. These packets of energy, which are called photons, can travel across space or through a medium as waves of energy.

# 21.2 Properties of Electromagnetic Waves

## Lesson Quiz

**Name**_____ **Class**_____ **Date**_____

**Multiple Choice**

*Circle the letter of the correct choice.*

1. How long does it take electromagnetic radiation to reach Earth from the sun?
    a. 1 second
    b. 7.5 seconds
    c. 8 minutes
    d. 93 minutes
2. What happens to light when it passes from water to air?
    a. Its speed decreases.
    b. Its frequency increases.
    c. Its wavelength decreases.
    d. none of the above
3. If the frequency of an electromagnetic wave is $6.0 \times 10^8$ hertz, what is its wavelength?
    a. 0.5 m
    b. 1.0 m
    c. 1.5 m
    d. 2.0 m
4. Electromagnetic waves with the lowest frequencies may have wavelengths as long as
    a. many kilometers.
    b. a few meters.
    c. a couple of centimeters.
    d. a fraction of a millimeter.
5. Which statement about electromagnetic waves is true?
    a. An electromagnetic wave with a shorter wavelength has a lower frequency.
    b. All electromagnetic waves travel at the same speed across space.
    c. All electromagnetic waves are harmful.
    d. none of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Electromagnetic waves travel more quickly through a medium than they do across space.

_____ 7. The highest-frequency electromagnetic waves may have frequencies of trillions of hertz.

_____ 8. Light is diffracted when it passes from air to water at an angle.

_____ 9. Light has a faster speed across space than do any other wavelengths of electromagnetic radiation.

_____ 10. If you know only the wavelength of an electromagnetic wave, you can calculate its frequency.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The fastest known speed in the universe is the speed of _____.

12. The frequency of an electromagnetic wave is inversely related to its _____.

13. A shorter-wavelength electromagnetic wave has _____ energy than a longer-wavelength electromagnetic wave.

14. The speed of an electromagnetic wave is a product of its wavelength and _____.

15. The speed of the highest-frequency electromagnetic waves when they travel through space is _____ m/s.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain the relationships among speed, wavelength, and frequency of electromagnetic waves.

17. Describe the range of frequencies and wavelengths of electromagnetic waves.

## Answer Key

1. c 2. d 3. a 4. a 5. b

6. false 7. true 8. false 9. false 10. true

11. light 12. wavelength 13. more 14. frequency 15. $3.0 \times 10^8$ (300 million)

16. The speed of an electromagnetic wave is a product of its wavelength and frequency. All electromagnetic waves have the same speed across space, so the higher the frequency of an electromagnetic wave, the shorter its wavelength

must be. In other words, the frequency and wavelength of electromagnetic waves, like other waves, have an inverse relationship.

17. Frequencies of electromagnetic waves range from thousands to trillions of waves per second. Wavelengths of electromagnetic waves range from many kilometers to a tiny fraction of a millimeter.

# 21.3 The Electromagnetic Spectrum

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which electromagnetic waves are used for cell phone signals?
    a. X rays
    b. microwaves
    c. gamma rays
    d. none of the above
2. Which choice lists electromagnetic waves in the correct sequence from higher to lower frequencies?
    a. microwaves, infrared light, visible light
    b. ultraviolet light, X rays, gamma rays
    c. X rays, ultraviolet light, visible light
    d. radio waves, microwaves, infrared light
3. Electromagnetic waves that have the least amount of energy are
    a. radio waves.
    b. infrared light.
    c. visible light.
    d. ultraviolet light.
4. What color does the shortest wavelength of visible light appear to the human eye?
    a. red
    b. yellow
    c. orange
    d. violet
5. X rays are used for
    a. tracking storms.
    b. killing bacteria.
    c. screening luggage at airports.
    d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Ultraviolet light has shorter wavelengths than visible light.

_____ 7. Television broadcasts cannot pass through the ionosphere.

_____ 8. Television broadcasts encode pictures with amplitude modulation.

_____ 9. Infrared light is used to sterilize surgical instruments.

_____ 10. X rays cannot pass through lead.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The most energetic of all electromagnetic waves are _____.

12. Electromagnetic waves with the longest wavelengths are _____.

13. Light with the shortest wavelengths is called _____.

14. Radar makes use of the radio waves called _____.

15. The skin makes vitamin D when it is exposed to _____ light.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain how radar works to detect the speed of oncoming cars.

17. Compare and contrast the use of radio waves in AM and FM radio broadcasts. What are the pros and cons of each type of broadcast?

## Answer Key

1. b 2. c 3. a 4. d 5. c

6. true 7. false 8. true 9. false 10. true

11. gamma rays 12. radio waves 13. ultraviolet light 14. microwaves 15. ultraviolet

16. A radar gun is used to send out short bursts of microwaves. The microwaves reflect back from oncoming cars. The time it takes for the microwaves to return to the radar gun is used to compute the speed of the cars.

17. AM means amplitude modification. In AM broadcasts, sound signals are encoded by changing the amplitude of radio waves. FM means frequency modulation. In FM broadcasts, sound signals are encoded by changing the frequency of radio waves. AM broadcasts use longer-wavelength radio waves than do FM broadcasts. Because of their longer wavelength, AM radio waves reflect off the ionosphere in the upper atmosphere. This allows AM radio waves to reach radio receivers that are very far away from the radio tower. Because of their shorter wavelength, FM radio waves pass through the ionosphere instead of being reflected back, so they cannot reach receivers that are very far away. On the other hand, frequency modulation allows FM waves to encode more information than does amplitude modulation, so FM broadcasts usually sound clearer than AM broadcasts do.

# 21.4 Electromagnetic Radiation

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. What do microwaves and waves in a rope have in common?
   a. Both are mechanical waves.
   b. Both are transverse waves.
   c. Both travel only through matter.
   d. two of the above
2. Albert Einstein's theory about the nature of electromagnetic radiation is the
   a. wave-particle theory.
   b. photon-particle theory.
   c. wave-energy theory.
   d. photon-energy theory.
3. Which of the following is not an example of electromagnetic radiation?
   a. light
   b. heat
   c. X rays
   d. radio waves
4. Which statement about the speed of electromagnetic waves is true?
   a. They travel more quickly through a medium than across space.
   b. They travel at the same speed through all media.
   c. They always travel at the speed of light.
   d. none of the above
5. Frequencies of electromagnetic waves range from
   a. billions to trillions of hertz.
   b. thousands to trillions of hertz.
   c. hundreds to millions of hertz.
   d. hundreds to thousands of hertz.
6. Which electromagnetic waves are used for television broadcasts?
   a. radio waves
   b. television waves
   c. infrared waves
   d. ultraviolet waves
7. Radar is used for
   a. tracking storms.

b. detecting air traffic.
c. determining the speed of cars.
d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. An electromagnetic wave begins when a charged particle vibrates.

_____ 9. An electromagnetic wave consists of two vibrating electric fields.

_____ 10. The most important source of electromagnetic radiation on Earth is the sun.

_____ 11. The speed of an electromagnetic wave is a product of its wavelength and frequency.

_____ 12. An electromagnetic wave with a higher frequency has a longer wavelength.

_____ 13. The speed of light across space is $3.0 \times 10^8$ meters per second.

_____ 14. The higher the frequency of an electromagnetic wave, the more energy it has.

_____ 15. Infrared light is used to kill bacteria.

_____ 16. The color of visible light depends on its wavelength.

_____ 17. Television broadcasts encode sounds with frequency modulation.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. When electromagnetic waves strike an obstacle, they may spread out around it, or _____.

19. A vibrating electric field creates a vibrating _____.

20. Electromagnetic radiation behaves as both a particle and as a(n) _____.

21. The wavelength of an electromagnetic wave equals its speed divided by its _____.

22. Electromagnetic waves with the shortest wavelengths are _____.

23. FM radio broadcasts encode sound by changing the _____ of radio waves.

24. Light with the longest wavelengths is classified as _____ light.

25. The full range of wavelengths of electromagnetic radiation is called the _____.

**Short Answer**

*Answer the following questions in complete sentences.*

26. What is sunlight? How does it travel from the sun to Earth, and how does it warm Earth's surface?

27. Explain how you can calculate the wavelength of an electromagnetic wave if you know only its frequency.

28. Describe the electromagnetic spectrum. How do electromagnetic waves vary from one end of the spectrum to the other?

## Answer Key

1. b 2. a 3. b 4. d 5. b 6. a 7. d

8. true 9. false 10. true 11. true 12. false 13. true 14. true 15. false 16. true 17. true

18. diffract 19. magnetic field 20. wave 21. frequency 22. gamma rays 23. frequency 24. infrared 25. electromagnetic spectrum

26. Sunlight is electromagnetic radiation that travels outward from the sun across space in all directions. Sunlight travels to Earth in electromagnetic waves, which are transverse waves that consist of vibrating electric and magnetic fields. When sunlight strikes Earth's surface, some of the electromagnetic radiation is converted to thermal energy that warms Earth's surface.

27. All electromagnetic waves travel at the speed of light across space, which is $3.0 \times 10^8$ meters per second. The speed of a wave equals its wavelength times its frequency. Since the speed of all electromagnetic waves is the same, then knowing only a wave's frequency allows you to calculate its wavelength. You would use the equation $\text{Wavelength} = \frac{\text{Speed}}{\text{Frequency}}$. You would substitute $3.0 \times 10^8$ m/s for Speed and the wave's frequency for Frequency. Then you would solve the equation for Wavelength.

28. The electromagnetic spectrum is the full range of wavelengths of electromagnetic radiation. At one end of the electromagnetic spectrum are radio waves, which have the longest wavelengths and lowest frequencies of all electromagnetic waves. Radio waves with the shortest wavelengths are called microwaves. At the other end of the electromagnetic spectrum are X rays and gamma rays, which have the shortest wavelengths and highest frequencies of all electromagnetic waves. In the middle of the spectrum, between the two extremes, are electromagnetic waves called light. The longest wavelengths of light are called infrared light, and the shortest wavelengths of light are called ultraviolet light. In between infrared and ultraviolet light is a narrow band of wavelengths called visible light. This is the only light that the human eye can detect.

# CHAPTER 22 Visible Light Assessments

## Chapter Outline



# 22.1 The Light We See

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Light bulbs that produce light by electroluminescence include
    a. neon light bulbs.
    b. vapor light bulbs.
    c. LED light bulbs.
    d. all of the above
2. You can see clearly through an object that is transparent because all of the light that strikes the object is
    a. transmitted.
    b. reflected.
    c. refracted.
    d. absorbed.
3. The shortest wavelength of visible light appears to the human eye as the color
    a. red.
    b. violet.
    c. yellow.
    d. magenta.
4. Why does a blackboard appear black?
    a. It reflects all wavelengths of visible light.
    b. It absorbs all wavelengths of visible light.
    c. It reflects only black wavelengths of visible light.
    d. It absorbs only black wavelengths of visible light.
5. Which of the following colors is a primary pigment color?
    a. red
    b. blue
    c. cyan
    d. green

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. A luminous object is an object that appears to glow because it is reflecting light from another source.

_____ 7. Some minerals produce visible light when they absorb ultraviolet light.

_____ 8. A neon light produces violet or blue light.

_____ 9. An object that reflects all the light that strikes it is opaque.

_____ 10. Fireflies glow with visible light because of chemical reactions.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Rainbows form because of the _____ of visible light.

12. The sun produces visible light through the process of _____.

13. The pigment chlorophyll reflects only _____ light.

14. An object is _____ if it transmits but scatters visible light.

15. The colors cyan, magenta, and yellow are the _____ colors of light.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Incandescent light bulbs are being replaced by compact fluorescent light bulbs because fluorescent light bulbs are more energy efficient. Explain why.

17. Assume you are a painter and have paints only in the three primary pigment colors. What are the colors of your paints? Explain how you could use your paints to make paints of other colors.

## Answer Key

1. d 2. a 3. b 4. b 5. c

6. false 7. true 8. false 9. true 10. true

11. refraction 12. incandescence 13. green 14. translucent 15. secondary

16. Incandescent light bulbs produce visible light when the filament inside the bulbs becomes so hot that it glows. This is not energy efficient because a lot of the energy the light bulb uses goes to heating the filament rather than producing light. Fluorescent light bulbs, in contrast, do not need to reach high temperatures in order to produce visible light. Instead, they produce light when a substance inside the bulbs absorbs ultraviolet light and then gives off the energy as visible light. Therefore, most of the energy fluorescent light bulbs use goes to producing light. This makes fluorescent light bulbs more energy efficient than incandescent light bulbs.

17. The primary colors of pigments are cyan, yellow, and magenta, so these are the colors of your paints. You could mix these paint colors together in different combinations and proportions to make paints of all other colors.

# 22.2 Optics

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. A convex lens
   a. is thicker at the edges than in the middle.
   b. forms only real upside-down images.
   c. may form enlarged or reduced images.
   d. causes rays of light to diverge.
2. Concave mirrors are used
   a. as side mirrors on cars.
   b. behind car headlights.
   c. in compound microscopes.
   d. in cameras.
3. The optical instrument that produces a beam of very focused light is a
   a. laser.
   b. microscope.
   c. telescope.
   d. none of the above
4. Which surface is most likely to result in diffuse reflection?
   a. completely still water in a puddle
   b. choppy water in a lake
   c. a plane glass mirror
   d. a convex mirror
5. A compound microscope contains
   a. convex lenses
   b. plane mirror
   c. convex mirror
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Moving the lens of a camera controls the amount of light that enters the camera.

_____ 7. A laser beam consists of photons of light of a single wavelength.

_____ 8. A reflecting telescope does not refract light.

_____ 9. Magnifications of all the lenses of a microscope are added to yield the overall magnification of the microscope.

_____ 10. Light refracts when it enters a new medium at an angle other than 90 °.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A lens that curves outward like the outside of a bowl is a(n) _____ lens.

12. A mirror with a flat surface is called a(n) _____ mirror.

13. A(n) _____ is a copy of an object formed by reflected or refracted light.

14. _____ is the study of visible light and ways we can use it.

15. A(n) _____ lens forms only upright virtual images.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain how a refracting telescope makes enlarged images of distant objects.

17. Explain how the focal point is related to the type of image formed by a concave mirror.

## Lesson Quiz Answer Key

1. c 2. b 3. a 4. b 5. d

6. false 7. true 8. false 9. false 10. true

11. convex 12. plane 13. image 14. Optics 15. concave

16. A refracting telescope uses a convex lens to collect and focus light. It uses another convex lens in the eyepiece to enlarge the image made by the first convex lens.

17. The type of image made by a concave mirror depends on where the object is placed relative to the focal point. If the image is farther from the mirror than the focal point is, then the image is real, upside down, and reduced in size. If the object is closer to the mirror than the focal point is, then the image is virtual, upright, and enlarged in size.

# 22.3 Vision

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which statement about the lens of the eye is true?
    a. It is a concave lens.
    b. Its shape is controlled by muscles.
    c. It is the only structure in the eye to focus light.
    d. all of the above
2. Images form inside the eye on the
    a. cornea.
    b. iris.
    c. pupil.
    d. retina.
3. The colored part of the eye is the
    a. lens.
    b. rod.
    c. iris.
    d. cone.
4. The function of the structure in question 3 is to
    a. change images to electrical signals.
    b. fine-tune the focus of light.
    c. control the size of the pupil.
    d. adjust the position of the lens.
5. Electrical signals from the retina reach the brain through the
    a. visual nerve.
    b. optic nerve.
    c. optic rod.
    d. electrical rod.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. One function of the cornea is to protect the eye.

_____ 7. The role of the pupil is to help focus light.

_____ 8. Images formed by the eye are upright and virtual.

_____ 9. We can see only if information from the eyes reaches the brain.

_____ 10. Rods can sense dim light but not colors of light.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The membrane lining the back of the eye is the _____.

12. The transparent outer covering of the eye is the _____.

13. The opening at the front of the eye that lets in light is the _____

14. Laser surgery corrects vision problems by reshaping the _____.

15. Nerve cells in the retina that sense colors of light are called _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Identify four structures of the human eye and the role they play in vision.

17. Compare and contrast myopia and hyperopia, including how these two vision problems can be corrected.

## Answer Key

1. b 2. d 3. c 4. c 5. b

6. true 7. false 8. false 9. true 10. true

11. retina 12. cornea 13. pupil 14. cornea 15. cones

16. Answers may vary and may include any four structures of the eye and their role in vision. *Sample answer*: Four structures of the eye are the cornea, pupil, lens, and retina. The cornea is the transparent outer covering of the eye. It helps focus light. The pupil is the opening at the front of the eye. It allows light to enter the eye. The lens is a

convex lens that fine-tunes the focus so an image forms on the retina. The retina is a membrane lining the back of the eye. Nerve cells in the retina, called rods and cones, change the image to electrical impulses that travel to the brain.

17. Myopia, or nearsightedness, and hyperopia, or farsightedness, are two of the most common vision problems. Myopia occurs when the eyeball is longer than normal, so images focus in front of the retina. Nearby objects can be seen clearly, but distant objects appear blurry. Hyperopia occurs when the eyeball is shorter than normal, so images focus in back of the retina. Distant objects can be seen clearly, but nearby objects appear blurry. Both vision problems can be corrected with lenses. Myopia is corrected with concave lenses, whereas hyperopia is corrected with convex lenses.

# 22.4 Visible Light

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which of the following objects is translucent?
   a. clear window
   b. frosted window
   c. glass mirror
   d. wooden door
2. What causes the object in question one to be translucent?
   a. It reflects light.
   b. It refracts light.
   c. It scatters light.
   d. It absorbs light.
3. Which of the following objects appears to glow because it is illuminated?
   a. sun
   b. firefly
   c. light bulb
   d. none of the above
4. The image formed by a plane mirror is
   a. upright.
   b. virtual.
   c. life-sized.
   d. all of the above
5. Which statement about a reflecting telescope is true?
   a. It uses a convex mirror to collect and focus light.
   b. It uses a plane mirror to reflect light into the eyepiece.
   c. It uses a convex lens to collect light from distant objects.
   d. It uses a concave lens in the eyepiece to enlarge the image.
6. Structures of the human eye collect light and focus images on the
   a. lens.
   b. iris.
   c. cornea.
   d. retina.
7. Which statement about hyperopia is true?
   a. It is also called nearsightedness.

b. It causes distant objects to appear blurry.
c. It occurs because of the shape of the eye.
d. It can be corrected with concave lenses.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. A prism separates visible light into light of different wavelengths by diffraction.

_____ 9. A banana appears to be yellow because it absorbs only yellow light.

_____ 10. The color of a transparent object is determined by the color of light it transmits.

_____ 11. Optics is the study of visible light and the ways it can be used.

_____ 12. Convex mirrors can form both real and virtual images.

_____ 13. You focus a microscope by moving the lenses up or down.

_____ 14. Light enters a camera through an opening called the shutter.

_____ 15. The images formed by the human eye are real, reduced, and upright.

_____ 16. We could not see without the brain to interpret images formed by the eyes.

_____ 17. Cells in the eye that are good at sensing dim light are called rods.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. An object is _____ if it absorbs or reflects all the light that strikes it.

19. A vapor light produces visible light by the process of _____.

20. The moon appears to glow because it _____ visible light.

21. A(n) _____ lens is thicker in the middle than it is at the edges.

22. _____ reflection occurs when a rough surface reflects light and makes a blurry image.

23. The type of lens that can form real images is a(n) _____ lens.

24. Both microscopes and telescopes use _____ lenses to make enlarged images.

25. Myopia occurs when the eyeball is _____ than normal.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Black is not a color of light, but some objects appear black. Explain why.

27. Compare and contrast concave and convex lenses.

28. Explain how the eyes and brain work together to enable vision.

## Answer Key

1. b 2. c 3. d 4. d 5. b 6. d 7. c

8. false 9. false 10. true 11. true 12. false 13. true 14. false 15. false 16. true 17. true

18. opaque 19. electroluminescence 20. reflects 21. convex 22. Diffuse 23. convex 24. convex 25. longer

26. Black is not a color of light but the absence of light. An object appears black when it absorbs all the light that strikes it and reflects no light into our eyes.

27. Both concave and convex lenses are transparent objects, typically made of glass, with one or two curved surfaces. Both types of lenses refract light and form images. However, the two types of lenses have different shapes and form different types of images. A concave lens is thinner in the middle than it is at the edges, and it causes rays of light to diverge, or spread apart. The image formed by a concave lens is always virtual, upright, and reduced in size. A convex lens, in contrast, is thicker in the middle than it is at the edges, and it causes rays of light to converge, or come together. The type of image formed by a convex lens depends on where the object is placed relative to the focus of the lens. The image may be virtual, upright, and enlarged; or the image may be real, upside-down, and variable in size.

28. The eyes collect and focus visible light. The lens and other structures of the eye work together to focus a real image on the retina. The image is upside-down and reduced in size. Rods and cones in the retina change the image to electrical signals, which travel through the optic nerve to the brain. The brain interprets the electrical signals as shape, color, and brightness. It also interprets the upside-down image as though it were right-side up. In addition, the brain "tells" us what we are seeing.

# CHAPTER 23 Electricity Assessments

## Chapter Outline



# 23.1 Electric Charge

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Static electricity occurs whenever
   a. electric fields interact.
   b. particles exert electric force.
   c. charges build up on an object.
   d. electrons flow away from an object.
2. Both lightning bolts and electric current occur because of
   a. polarization.
   b. static discharge.
   c. static electricity.
   d. moving electric charges.
3. Electric field lines around a positively charged particle
   a. repel the particle.
   b. attract the particle.
   c. point toward the particle.
   d. point away from the particle.
4. If you rub a piece of wool cloth on a balloon, friction causes the
   a. wool to transfer electrons to the balloon.
   b. balloon to become negatively charged.
   c. balloon to attract the wool.
   d. all of the above
5. The movement of air molecules, water droplets, and ice particles inside a cloud causes the
   a. transfer of electric charges within the cloud.
   b. top of the cloud to become negatively charged.
   c. bottom of the cloud to become positively charged.
   d. all of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. A charged particle exerts force over a distance because the particle has an electric field.

_____ 7. The law of conservation of charge states that charges cannot move without being destroyed.

_____ 8. When you touch a van de Graaff generator, electrons flow to you from the device.

_____ 9. Polarization is the transfer of electrons between oppositely charged objects.

_____ 10. The ground beneath a storm cloud becomes positively charged by conduction.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The transfer of electrons that occurs when one object rubs on another is called _____.

12. _____ is the sudden flow of electrons from an object that has a buildup of charges.

13. The force of attraction or repulsion between charged particles is known as _____.

14. Two negatively charged particles always _____ each other.

15. Cations form when atoms _____ electrons.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Describe three ways that charges can be transferred, and give an example of each.

17. Assume that you walk across a wool carpet in rubber-soled shoes. Then you reach out to touch a metal doorknob and get a shock. Explain why.

## Lesson Quiz Answer Key

1. c 2. d 3. d 4. d 5. a

6. true 7. false 8. true 9. false 10. false

11. friction 12. Static discharge 13. electric force 14. repel 15. lose

16. Charges can be transferred by friction, conduction, or polarization. Friction occurs when there is rubbing between materials that differ in their ability to give up or accept electrons. An example is rubbing a balloon on

your hair. Conduction occurs when there is simply contact between materials that differ in their ability to give up or accept electrons. An example is touching a van de Graaff generator. Polarization occurs when electrons move within a neutral object because of the electric field of a nearby charged object. This causes positive and negative regions within the object. An example is the ground becoming positively charged below the negatively charged bottom of a storm cloud.

17. When you walk across a wool carpet in rubber-soled shoes, electrons are transferred from the carpet to your shoes through conduction. This occurs because rubber attracts electrons more strongly than wool does. Then, when you reach out to touch a metal doorknob, polarization causes the side of the doorknob closest to your negatively charged hand to become positively charged. When your hand gets very close to the doorknob, static discharge occurs between your hand and the knob, causing you to feel a shock.

# 23.2 Electric Current

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The SI unit for electric current is the
   a. ampere.
   b. volt.
   c. ohm.
   d. watt.
2. What does voltage mean?
   a. electrical resistance
   b. potential difference
   c. flow of electric charges
   d. none of the above
3. Which statement about the electrodes in a battery is false?
   a. Electrodes react chemically with the electrolyte.
   b. Electrodes either give up or accept electrons.
   c. Electrodes are either positive or negative.
   d. Electrodes are either a paste or a liquid.
4. Copper electrical wires have a plastic coating because
   a. plastic is a very good electric insulator.
   b. plastic offers a lot of resistance to electric current.
   c. current flows through the material with the least resistance.
   d. all of the above
5. Assume that a wire has 1.5 ohms of resistance. If the wire is connected to two 1.5-volt batteries, how much current will flow through the wire?
   a. 3.0 amps
   b. 2.3 amps
   c. 2.0 amps
   d. 1.0 amps

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Electric current is a continuous flow of electric charges.

_____ 7. Greater resistance always results in more current.

_____ 8. An electric generator changes kinetic energy to electrical energy.

_____ 9. A battery with six electrodes contains six chemical cells.

_____ 10. Electric current can travel through matter or across space.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Opposition to the flow of electric current is known as _____.

12. Electric current flows through a wire only if there is a difference in electric _____.

13. A material that has high resistance to the flow of electric current is called an electric _____.

14. Electric current that keeps reversing direction is called _____.

15. A battery that contains a liquid electrolyte is referred to as a(n) _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain why cooling a wire lowers its resistance to electric current.

17. How is electric current related to voltage?

## Answer Key

1. a 2. b 3. d 4. d 5. c

6. true 7. false 8. true 9. false 10. false

11. resistance 12. potential energy 13. insulator 14. alternating current 15. wet cell

16. Cooling a wire lowers its resistance to electric current because the particles of the wire have less kinetic energy and move more slowly. Moving charges in current are less likely to collide with more slowly moving particles in the wire.

17. Voltage is a difference between two positions in their electric potential energy. Electric charges can move spontaneously only from a position with more potential energy to a position with less potential energy. Moving electric charges make up an electric current. Therefore, electric current requires voltage, and the greater the voltage the more current there is.

# 23.3 Electric Circuits

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

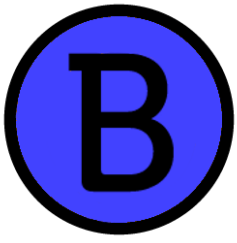
1. Most home circuits can carry a maximum current of about
   a. 240 amps.
   b. 120 amps.
   c. 60 amps.
   d. 30 amps.
2. The source of voltage in home electric circuits is a(n)
   a. electric outlet.
   b. large battery.
   c. power plant.
   d. breaker box.
3. Which of the following symbols represents a battery in a circuit diagram?

a.

b.

c.

d.




4. Which units are used to measure electrical energy use?
   a. amps
   b. ohms

c. watts
d. kilowatt-hours

5. What is the power of a device that uses 10 amps of current in a 120-volt circuit?

a. 12 kilowatts
b. 1.2 kilowatts
c. 0.2 kilowatts
d. 0.1 kilowatts

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. All electric circuits must include a voltage source and a switch.

_____ 7. Electrical energy use is a product of current and time.

_____ 8. GFCI outlets are used in kitchens and bathrooms.

_____ 9. Water is a very good electrical conductor.

_____ 10. A damaged electric cord can cause an electric short.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Any closed loop through which a current can flow is a(n) _____.

12. A(n) _____ is any device that converts electric current to another form of energy.

13. _____ is the rate at which a device changes electric current to another form of energy.

14. A circuit that consists of a single loop is called a(n) _____ circuit.

15. A circuit that consists of two loops is called a(n) _____ circuit.

**Short Answer**

*Answer the following questions in complete sentences.*

16. In the past, string lights were manufactured in series circuits. What would happen if one of the light bulbs in a 100-light series string were to burn out? How would you know which bulb it was?

17. Identify two rules for using electricity safely, and explain the science behind each rule.

## Answer Key

1. d 2. c 3. c 4. d 5. b

6. false 7. false 8. true 9. true 10. true

11. electric circuit 12. resistor 13. Power 14. series 15. parallel

16. If one of the light bulbs were to burn out in a series circuit, all of the other light bulbs in the circuit would also go out. That's because the circuit would be interrupted and no current could flow through it. You would know which bulb had burned out only by replacing each bulb in sequence until all the lights came back on. The bulb you replaced when the lights came on would be the bulb that had burned out.

17. Answers may vary. *Sample answer*: One rule is never to plug in an appliance when your hands are wet. Water is a very good conductor of electricity, so current could flow through the water to you if you have wet hands. Another rule is to avoid plugging too many devices into one outlet. The more devices that are plugged into an outlet the more current the circuit carries. Too much current can overheat a circuit and start a fire.

# 23.4 Electronics

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which of the following electric devices uses electric current to encode information?
   a. lamp
   b. toaster
   c. steam iron
   d. microphone
2. Which of the following statements about n-type semiconductors is true?
   a. They consist of silicon and boron.
   b. They contain holes where electrons are missing.
   c. They are like the negative terminal of a chemical cell.
   d. all of the above
3. Which type of electronic component contains semiconductors?
   a. diodes.
   b. transistors.
   c. integrated circuits.
   d. all of the above
4. Integrated circuits are commonly known as
   a. motherboards.
   b. microchips.
   c. hard drives.
   d. CPUs.
5. Which statement applies to a binary code?
   a. It uses continuous changes in voltage.
   b. It is used for analog signals.
   c. It is based on 0's and 1's.
   d. It is an eight-digit code.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. A transistor can be used to increase the amount of current in a circuit.

_____ 7. A diode can be used as a switch in an electric circuit.

_____ 8. The role of the ROM microchip in a computer is to provide temporary storage.

_____ 9. DVDs use digital signals to encode sounds and pictures.

_____ 10. Any device that uses electric current is an electronic device.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The use of electric current to encode information is called _____.

12. An electronic signal created by a continuous change in voltage is a(n) _____ signal.

13. An electronic signal created by pulses of voltage is a(n) _____ signal.

14. A(n) _____ is a crystal that conducts current better than an insulator but not as well as a conductor.

15. An electronic component consisting of just two semiconductors is a(n) _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Explain why a crystal of pure silicon cannot conduct electric current but a silicon crystal with a tiny amount of added phosphorus can.

17. Identify an electronic device that you commonly use. How does the device use electric current?

## Answer Key

1. d 2. c 3. d 4. b 5. c

6. true 7. false 8. false 9. true 10. false

11. electronics 12. analog 13. digital 14. semiconductor 15. diode

16. Silicon has four valence electrons. In a crystal of pure silicon, each atom of silicon bonds with four other silicon atoms, giving each atom a total of eight valence electrons. Therefore, there are no free electrons that could conduct

electric current. Phosphorus has five valence electrons. When a tiny amount of phosphorus is added to a silicon crystal, each phosphorus atom binds with four silicon atoms, leaving it with one free electron. The free electrons of the added phosphorus atoms allow the crystal to conduct electric current.

17. Answers may vary. *Sample answer*: An electronic device that I commonly use is a cell phone. It uses electric current to encode and transmit sounds, text, and pictures.

# 23.5 Electricity

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Polarization is the transfer of electric charges
   a. from one object to another.
   b. between two charged particles.
   c. by static discharge.
   d. within an object.
2. Which statement about electric charge is false?
   a. Electric charge is a chemical property of particles or objects.
   b. Particles with the same electric charge repel each other.
   c. Electric charge results from the transfer of electrons.
   d. Electric charge may be positive or negative.
3. The SI unit called the ohm measures electric
   a. power.
   b. current.
   c. voltage.
   d. resistance.
4. Which energy transformation occurs in a solar cell?
   a. electrical energy $\rightarrow$ chemical energy
   b. chemical energy $\rightarrow$ thermal energy
   c. thermal energy $\rightarrow$ light energy
   d. light energy $\rightarrow$ electrical energy
5. A switch allows current to flow through a circuit by
   a. closing the circuit.
   b. turning off the resistor.
   c. turning on the power.
   d. turning on the voltage source.
6. Which statement about parallel circuits is true?
   a. They have a single loop.
   b. They are used in flashlights.
   c. They are used in houses.
   d. two of the above
7. Which statement about semiconductors is false?
   a. They consist mainly of silicon.

b. They contain either boron or phosphorus.
c. They are the basis of all electronic components.
d. They are better electric conductors than any other material.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Lightning is an example of static discharge.

_____ 9. The strength of electric force depends only on the distance between charged particles.

_____ 10. Plastic attracts electrons more strongly than hair does.

_____ 11. Aluminum is a material with high resistance to electric current.

_____ 12. Adding more wire to a circuit reduces resistance.

_____ 13. Electric current is inversely related to voltage.

_____ 14. GFCI outlets are installed in rooms where water is used.

_____ 15. The amount of electrical energy used by a device depends on its power and how long it is used.

_____ 16. A diode can be used to change alternating current to direct current.

_____ 17. A computer's CPU carries out program instructions.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. The buildup of electric charges on an object is called _____.

19. The space around a charged particle where it exerts electric force is its _____.

20. A continuous flow of electric charges is a(n) _____.

21. _____ is a difference in electric potential energy between two positions.

22. All electric circuits must have a conductor and a source of _____.

23. Electrical power is measured in the SI unit called the _____.

24. Electronic devices encode information by changing the _____ of electric current.

25. The type of electronic component that consists of three semiconductors is a(n) _____.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Explain why charged particles do not have to be touching in order to exert force over each other.

27. Explain how wet and dry cells create voltage.

28. Compare and contrast diodes and transistors.

## Answer Key

1. d 2. a 3. d 4. d 5. a 6. c 7. d

8. true 9. false 10. true 11. false 12. false 13. false 14. true 15. true 16. true 17. true

18. static electricity 19. electric field 20. electric current 21. Voltage 22. voltage 23. watt 24. voltage 25. transistor

26. Charged particles do not have to be touching in order to exert force over each other because electric force is exerted over a distance. This is due to the fact that each charged particle is surrounded by an electric field. This is a space around a charged particle where the particle exerts electric force on other charged particles.

27. A wet or dry cell contains two electrodes that react chemically with an electrolyte, which is a substance containing ions that can conduct electric current. The chemical reactions cause one electrode to give up electrons and become positively charged and the other electrode to accept electrons and become negatively charged. This difference in charges between the two electrodes creates a difference in electric potential energy, or voltage.

28. Both diodes and transistors are small electronic components that consist of semiconductors and are used to make electronic devices. A diode has two semiconductors, one p-type semiconductor and one n-type semiconductor. A transistor has three semiconductors, either p-n-p or n-p-n. When a diode is connected to a voltage source, current flows through the diode, but only from the n-type to the p-type semiconductor. This makes a diode useful for changing alternating current to direct current. A transistor must have a small amount of current applied to the center semiconductor in order for a larger current to flow through the transistor. This allows the transistor to act as a switch, with pulses of small current turning a larger current on and off. A transistor can also be used to increase the amount of current flowing through a circuit.

# CHAPTER 24 Magnetism Assessments

## Chapter Outline



# 24.1 Magnets and Magnetism

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. A maglev train can hover above the track without touching it because of
   a. friction.
   b. magnetic force.
   c. static electricity.
   d. none of the above
2. Ferromagnetic materials include
   a. iron.
   b. nickel.
   c. cobalt.
   d. all of the above
3. If a magnet is allowed to move freely, its north and south poles will always
   a. line up with Earth's north-south axis.
   b. keep changing places.
   c. point east and west.
   d. repel each other.
4. How is magnetic force like electric force?
   a. It is caused by moving electrons.
   b. It generates a force field.
   c. It acts over a distance.
   d. all of the above
5. Magnetic domains in a ferromagnetic material are most likely to align in the same direction when the material is
   a. heated to a high temperature.
   b. placed near a magnet.
   c. dropped on a hard surface.
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. An atom is a tiny magnet because its electrons spin around its nucleus.

_____ 7. Copper and aluminum are attracted by magnets.

_____ 8. Only temporary magnets can be demagnetized.

_____ 9. The most magnetic material in nature is magnetite.

_____ 10. An iron nail can be turned into a permanent magnet.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. An object that attracts ferromagnetic materials is a(n) _____.

12. The north or south end of a magnet is known as a magnetic _____.

13. _____ is the ability of a material to respond to and exert magnetic force.

14. An area of a ferromagnetic material where the poles of all the atoms are aligned is a(n) _____.

15. The area around a magnet where it exerts magnetic force is its _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Describe how magnetic fields interact.

17. Explain how a ferromagnetic material becomes a magnet.

## Answer Key

1. b 2. d 3. a 4. d 5. b

6. true 7. false 8. false 9. true 10. true

11. magnet 12. pole 13. Magnetism 14. magnetic domain 15. magnetic field

16. When two magnets are brought close together, their magnetic fields interact. If a north pole and south pole are brought close together, they attract each other and their magnetic field lines merge together. If two north poles or two south poles are brought together, they repel each other and their magnetic field lines push apart.

17. A ferromagnetic material becomes a magnet when it is placed in a magnetic field. This causes its magnetic domains to align in the same direction, giving the material north and south poles and a magnetic field.

# 24.2 Earth as a Magnet

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The idea that Earth is a magnet was first proposed in
   a. 1600.
   b. 1700.
   c. 1800.
   d. 1900.
2. The magnetosphere is
   a. a huge region.
   b. strongest at the poles.
   c. the region where Earth exerts magnetic force.
   d. all of the above
3. What causes Earth's magnetism?
   a. The movement of charged particles in Earth's outer core.
   b. The revolution of Earth around the sun.
   c. The magnetism of the sun.
   d. none of the above
4. Evidence for magnetic field reversals comes from
   a. rocks on the ocean floor.
   b. metals in Earth's liquid core.
   c. measurements of Earth's magnetosphere.
   d. seismograph readings from inside Earth.
5. Earth's magnetic field is beneficial to living things because it
   a. protects them from harmful particles.
   b. can be used for navigation.
   c. never changes.
   d. two of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Earth has north and south magnetic poles like a bar magnet.

_____ 7. Earth's magnetic and geographic poles are located in the same places.

_____ 8. Scientists no longer accept the idea of magnetic reversals.

_____ 9. Earth's magnetic field occurs only over the north and south poles.

_____ 10. Earth's magnetic force is exerted over a distance.

**Fill in the Blank**

*Fill in the blank with the appropriate term*

11. Earth's magnetic field is called the _____.

12. Earth's liquid outer core consists mainly of iron and _____.

13. A(n) _____ occurs when Earth's magnetic poles switch places.

14. Earth's north _____ pole is located at about 80 ° north latitude.

15. A(n) _____ is a navigation device that always points north.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Describe the magnetosphere.

17. Relate Earth's magnetism to its rotation.

## Answer Key

1. a 2. d 3. a 4. a 5. d

6. true 7. false 8. false 9. false 10. true

11. magnetosphere 12. nickel 13. magnetic reversal 14. magnetic 15. compass

16. The magnetosphere is a huge region that extends outward from Earth for several thousand kilometers in all directions. It is has lines of force that converge at the magnetic north and south poles, where Earth's magnetic force is strongest.

17. Scientists think that Earth's magnetism is generated by the movement of charged particles through the liquid outer core. The particles move because of Earth's rotation. Rotation refers to how Earth continuously spins on its axis.

# 24.3 Magnetism

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Electrons spinning around the nucleus of an atom cause the atom to
    a. be a tiny magnet.
    b. have north and south poles.
    c. have a magnetic field.
    d. all of the above
2. Which statement about magnetic force is false?
    a. It can be exerted over a distance.
    b. It is weakest near the poles of a magnet.
    c. It includes both attraction and repulsion.
    d. It occurs as lines of force in a force field.
3. An iron nail becomes a permanent magnet if it is
    a. surrounded by a magnetic field.
    b. placed in a magnetic domain.
    c. attracted by another magnet.
    d. stroked with a bar magnet.
4. When it comes to magnetism, Earth is most like a(n)
    a. iron nail.
    b. paper clip.
    c. bar magnet.
    d. horseshoe magnet.
5. A compass needle aligns itself with Earth's
    a. axis.
    b. equator.
    c. lines of latitude.
    d. none of the above
6. Which statement about the magnetosphere is false?
    a. It is the name of Earth's magnetic field.
    b. It is found only over Earth's magnetic poles.
    c. It extends outward from Earth in all directions.
    d. It protects Earth from harmful particles from the sun.
7. Scientists know Earth's magnetic poles have switched places in the past because
    a. magnetic domains in rocks are aligned in opposite directions.

b. Earth keeps changing the direction of its rotation.
c. Earth's outer core consists of liquid metals.
d. Earth spins on its north-south axis.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. All magnets have north and south magnetic poles.

_____ 9. Only bar magnets have a magnetic field.

_____ 10. Refrigerator magnets will stick to any metal surface.

_____ 11. The north poles of atoms are aligned in the same direction in a magnetic domain.

_____ 12. The magnetic domains of iron naturally align with Earth's axis.

_____ 13. Earth is surrounded by lines of magnetic force.

_____ 14. Reversals of Earth's magnetic field have occurred only a few times in the past.

_____ 15. The magnetic domains in solid rock can keep changing direction.

_____ 16. Some birds may be able to see Earth's magnetic field as a visual pattern.

_____ 17. The idea that Earth is a magnet was first proposed by William Gilbert.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. A magnet is an object that attracts _____ materials.

19. The north poles of two magnets _____ each other.

20. Magnetism is due to the movement of _____ within atoms.

21. A paper clip clinging to a bar magnet is a(n) _____ magnet.

22. Ferromagnetic materials include iron, cobalt, and _____.

23. Earth's magnetic field is generated by the movement of _____ in its outer core.

24. Living things use Earth's magnetic field for _____.

25. Earth's north magnetic pole is located at about _____ north latitude.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Compare and contrast nonmagnetic and ferromagnetic materials.

27. Describe the magnetic field of a bar magnet.

28. If opposite magnetic poles attract each other, why does the north end of a compass needle point north instead of south?

## Answer Key

1. d 2. b 3. d 4. c 5. a 6. b 7. a

8. true 9. false 10. false 11. true 12. false 13. true 14. false 15. false 16. true 17. true

18. ferromagnetic 19. repel 20. electrons 21. temporary 22. nickel 23. charged particles (electrons) 24. navigation 25. 80°

26. In nonmagnetic materials, the north and south poles of atoms point in all different directions, so the materials are not magnetic. These materials are not attracted to magnets and cannot become magnets. In ferromagnetic materials, there are large areas, called magnetic domains, where the north and south poles of atoms are all lined up in the same direction. If these materials are placed in a magnetic field, all the magnetic domains become aligned, and the materials become magnets.

27. The magnetic field of a bar magnet consists of curving lines of magnetic force that surround the magnet. The lines converge and are most concentrated at the two ends of the bar magnet where the north and south poles are located.

28. The north end of a compass needle actually points toward Earth's true south magnetic pole. However, this pole is located near the north geographic pole. So, to avoid confusion, the pole is referred to as the north magnetic pole, even though it is really the south magnetic pole.

CHAPTER 25

# Electromagnetism Assessments

## Chapter Outline



# 25.1 Electricity and Magnetism

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Oersted was the scientist who discovered how
   a. a magnetic compass works.
   b. magnetism causes an electric current.
   c. electricity and magnetism are related.
   d. electric charges flow through a wire.
2. To use the right hand rule, you should point your thumb in the same direction as the
   a. voltage source.
   b. magnetic field.
   c. electric current.
   d. none of the above
3. Assume that a wire is connected to a battery so current is flowing through the wire. If you place a compass near the wire, the needle of the compass will point toward
   a. the wire.
   b. the battery.
   c. your thumb.
   d. none of the above
4. If you disconnect one end of the wire in question 3 from the battery, the compass needle will point toward
   a. the loose end of the wire.
   b. Earth's north magnetic pole.
   c. the fingers of your right hand.
   d. the end of the wire still attached to the battery.
5. If you increase the amount of current flowing through a wire, the magnetic field around the wire will
   a. remain the same.
   b. change direction.
   c. increase in strength.
   d. decrease in strength.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Moving electric charges generate a magnetic field.

_____ 7. When you apply the right hand rule, your thumb points in the direction of the magnetic field.

_____ 8. The direction of the magnetic field around a wire carrying current is the same as the direction of the current.

_____ 9. A compass can be used to find the direction of a magnetic field around a current-carrying wire.

_____ 10. The magnetic field created by current flowing through a wire surrounds the wire in concentric circles.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. Magnetism produced by an electric current is called _____.

12. A(n) _____ is a continuous flow of electric charges.

13. A(n) _____ is a material through which electric current can flow.

14. A device that points toward a north magnetic pole is called a(n) _____.

15. The right hand rule is used to find the _____ of the magnetic field around a wire that is carrying current.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Outline how Oersted accidentally discovered that an electric current creates a magnetic field.

17. Identify two factors that affect the magnetic field surrounding a wire that is carrying electric current.

## Answer Key

1. c 2. c 3. a 4. b 5. c

6. true 7. false 8. false 9. true 10. true

11. electromagnetism 12. electric current 13. electric conductor 14. compass 15. direction

16. Oersted accidentally discovered that an electric current creates a magnetic field when he was presenting a demonstration to his students. He was trying to show them that electricity and magnetism are not related. He placed a wire with electric current flowing through it next to a compass and nothing happened. However, when a student

held the compass in a different direction, its pointer swung toward the wire so it was no longer pointing to Earth's north magnetic pole. Then, when Oersted turned off the current, the pointer swung back to its original position, pointing north once again. Oersted had discovered than an electric current creates a magnetic field.

17. Two factors that affect the magnetic field surrounding a wire that is carrying electric current are the amount of current and the direction of the current. The more current the wire is carrying, the stronger is the magnetic field around the wire. Reversing the direction of the electric current also reverses the direction of the magnetic field.

# 25.2 Using Electromagnetism

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Factors that affect the strength of a solenoid's magnetic field include the
   a. amount of current flowing through the wire.
   b. direction in which the current flows.
   c. number of turns in the wire.
   d. two of the above
2. In an electromagnet, the solenoid magnetizes the iron bar by
   a. reversing the direction of the current.
   b. repeatedly turning the current on and off.
   c. aligning the magnetic domains of the iron.
   d. causing electric current to flow through the bar.
3. What happens when the clapper of an electric doorbell moves to strike the bell?
   a. The electromagnet turns on.
   b. The doorbell's circuit is broken.
   c. The voltage source causes current to flow.
   d. two of the above
4. When current flows through an electric motor, its electromagnet
   a. repels the shaft.
   b. rotates continuously.
   c. controls the commutator.
   d. attracts the permanent magnets.
5. Why do the poles of the electromagnet in an electric motor keep reversing?
   a. The shaft keeps rotating.
   b. The permanent magnets keep moving.
   c. The current keeps changing direction.
   d. The voltage source keeps turning off and on.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. A coiled wire has a weaker magnetic field than a straight wire.

_____ 7. An electromagnet is stronger if more current flows through it.

_____ 8. Electromagnets are not as strong as naturally occurring magnets.

_____ 9. Electric devices that contain electromagnets include hair dryers.

_____ 10. Most electric devices with moving parts contain electric motors.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. A(n) _____ is a coil of wire with electric current flowing through it, giving it a magnetic field.

12. A solenoid wrapped around a bar of ferromagnetic material is a(n) _____.

13. A device that uses an electromagnet to change electrical energy to kinetic energy is a(n) _____.

14. The part of an electric motor that is turned by the rotating electromagnet is the _____.

15. The part of an electric motor that changes the direction of the current is the _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Compare and contrast a solenoid and a bar magnet.

17. Explain how an electric doorbell works.

## Answer Key

1. d 2. c 3. b 4. b 5. c

6. false 7. true 8. false 9. true 10. true

11. solenoid 12. electromagnet 13. electric motor 14. shaft 15. commutator

16. A solenoid is a magnet with north and south poles like a bar magnet. However, a solenoid is a temporary magnet, because it has a magnetic field only when electric current flows through it. A bar magnet, in contrast, is a permanent magnet. A solenoid is a magnet because of moving charges in its wire coil, whereas a bar magnet is a

magnet because its magnetic domains are aligned in the same direction. When the current flowing through a solenoid changes direction, the poles of the solenoid's magnetic field reverse.When more or less current flows through the solenoid, the strength of its magnetic field increases or decreases. In contrast, the poles of a bar magnet do not reverse but instead always remain the same, and the strength of a bar magnet is also constant.

17. Pressing the button of a doorbell completes its electric circuit. This turns on its electromagnet, which attracts the clapper, causing it to strike the bell. The clapper is part of the circuit and when it moves to strike the bell, it opens the circuit. This turns off the electromagnet, so the clapper returns to its original position. This closes the circuit again and turns the electromagnet back on, so the sequence of events repeats. This continues as long as the doorbell button is being pressed.

# 25.3 Generating and Using Electricity

## Lesson Quiz

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which of the following sentences correctly states Faraday's law?
    a. The flow of electric current creates a changing magnetic field.
    b. Only an alternating current can produce a magnetic field.
    c. A rotating electromagnet has a changing magnetic field.
    d. A changing magnetic field produces an electric current.
2. Moving a magnet back and forth inside a coil of wire produces a(n)
    a. electromagnet.
    b. alternating current.
    c. increase in voltage.
    d. decrease in voltage.
3. Uses of electromagnetic induction include
    a. generating electricity.
    b. changing the voltage of current.
    c. changing electrical energy to kinetic energy.
    d. two of the above
4. An electric generator is the reverse of an
    a. electric transformer.
    b. electric motor.
    c. electromagnet.
    d. none of the above
5. An electric transformer with more turns of wire in coil S
    a. decreases the voltage of current.
    b. increases the amount of current.
    c. is a step-down transformer.
    d. none of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 6. Faraday's discovery is the reverse of Oersted's discovery about electric currents and magnetic fields.

_____ 7. Electromagnetic induction always requires movement of a magnet.

_____ 8. The current produced by a magnetic field is always alternating current.

_____ 9. The two coils of a transformer are connected to different electric circuits.

_____ 10. Power plant generators produce low-voltage electric current.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

11. The process of generating electric current with a changing magnetic field is called _____.

12. A device that uses electromagnetic induction to change kinetic energy to electrical energy is a(n) _____.

13. A device that uses electromagnetic induction to increase the voltage of electric current is a(n) _____.

14. A(n) _____ decreases the voltage of electric current with the use of electromagnetic induction.

15. Kinetic energy in a power plant is supplied by a(n) turning _____.

**Short Answer**

*Answer the following questions in complete sentences.*

16. Describe the process of electromagnetic induction.

17. Explain how an electric generator works.

## Answer Key

1. d 2. b 3. d 4. b 5. d

6. true 7. false 8. false 9. true 10. false

11. electromagnetic induction 12. electric generator 13. step-up transformer 14. step-down transformer 15. turbine

16. Electromagnetic induction is the process of generating electric current with a changing magnetic field. It occurs whenever a magnetic field and an electric conductor, such as coil of wire, move relative to one another. As long as

the conductor is part of a closed circuit, current will flow through it whenever it crosses magnetic field lines. This can happen when a magnet moves inside a coil of wire or when the coil moves instead of the magnet.

17. An electric generator is a device that changes kinetic energy to electrical energy through electromagnetic induction. Energy is applied to turn a shaft, which is connected to a coil of wire located between opposite poles of a magnet. The turning shaft causes the coil of wire to rotate. Because the coil is rotating in a magnetic field, electric current is generated in the wire.

# 25.4 Electromagnetism

## Chapter Test

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The right hand rule is used to find the
   a. positive terminal of a chemical cell.
   b. amount of electric current flowing through a wire.
   c. strength of the magnetic field around a coil of wire.
   d. direction of the magnetic field around a current-carrying wire.
2. The magnetic field around a straight wire that is carrying current is stronger when
   a. the direction of the current keeps changing.
   b. the amount of current is decreased.
   c. a compass is placed near the wire.
   d. none of the above
3. What would happen if the commutator were removed from an electric motor?
   a. The electromagnet would not turn.
   b. The permanent magnets would repel the shaft.
   c. The direction of the current would not change.
   d. two of the above
4. The shaft of an electric motor is turned directly by the
   a. commutator.
   b. electromagnet.
   c. electric current.
   d. permanent magnets.
5. All of the following devices contain electromagnets except
   a. electric motors.
   b. electric fans.
   c. telephones.
   d. solenoids.
6. A changing magnetic field can produce a(n)
   a. battery.
   b. solenoid.
   c. electromagnet.
   d. electric current.
7. The transformer outside of a house has the job of
   a. reducing the amount of current entering the house.

b. decreasing the voltage of current entering the house.
c. measuring the amount of current entering the house.
d. changing the direction of current entering the house.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Faraday discovered that an electric current generates a magnetic field.

_____ 9. If current is allowed to flow through a wire, the wire becomes a permanent magnet.

_____ 10. Adding more turns of wire to a solenoid increases the amount of current that flows through it.

_____ 11. Placing a bar of iron inside the coils of a solenoid creates an electromagnet.

_____ 12. A maglev train levitates above the track because of magnetic repulsion.

_____ 13. The electromagnet inside a doorbell strikes the bell when the button is pushed.

_____ 14. Oersted discovered electromagnetic induction.

_____ 15. Electric generators may be set up to produce either direct or alternating current.

_____ 16. A step-up transformer has more turns of wire in coil P than coil S.

_____ 17. Both electric generators and electric transformers are needed to safely provide electricity to homes.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. Electromagnetism refers to magnetism generated by a(n) _____.

19. Each turn of wire in a solenoid has its own _____.

20. When more current flows through a solenoid, its magnetic field is _____.

21. The electromagnet inside an electric doorbell attracts the _____.

22. An electric motor changes electrical energy to _____ energy.

23. The outcome of electromagnetic induction is a(n) _____.

24. Electromagnetic induction can be used to change the _____ of electric current.

25. A(n) _____ is a device that changes kinetic energy to electrical energy through electromagnetic induction.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Describe how to determine the direction of a magnetic field around a wire when the direction of current flowing through the wire is known.

27. Explain the function of the electromagnet in an electric motor.

28. Explain why an electric generator is an electric motor in reverse.

## Answer Key

1. d 2. d 3. d 4. b 5. d 6. d 7. b

8. false 9. false 10. false 11. true 12. true 13. false 14. false 15. true 16. false 17. true

18. electric current 19. magnetic field 20. stronger 21. clapper 22. kinetic 23. electric current 24. voltage 25. electric generator

26. To determine the direction of a magnetic field around a wire when the direction of current flowing through the wire is known, you would apply the right hand rule. With the thumb of the right hand pointing in the same direction as the current is flowing, the fingers of the right hand curl around the wire in the direction of the magnetic field.

27. The function of the electromagnet in an electric motor is to turn the shaft of the motor. The poles of the electromagnet are repelled by the like poles of two permanent magnets in the motor. The current to the electromagnet keeps changing direction, and this keeps reversing the poles of the electromagnet. Because the poles of the electromagnetic keep reversing, the electromagnet continuously turns away from the permanent magnets and keeps rotating. The shaft is connected to the electromagnet, so as the electromagnet rotates, the shaft turns as well.

28. An electric motor uses an electromagnetism to change electrical energy to kinetic energy. Electrical energy is used to magnetize an electromagnet, which is repelled by a permanent magnet. The magnetic repulsion causes the electromagnet—and the shaft attached to it—to turn. An electric generator is the reverse of an electric motor. An electric generator uses electromagnetic induction to change kinetic energy to electrical energy. Kinetic energy is used to move a conductor relative to a permanent magnet, which induces an electric current in the conductor.

# CHAPTER 26 Physical Science Unit Tests

## Chapter Outline

# 26.1 Unit 1: Science and Technology Test

Unit 1 chapters: *The World of Science* and *Scientific Research and Technology*

**Name**_____ **Class**_____ **Date**_____

**Multiple Choice**

*Circle the letter of the correct choice.*

1. The person who first proposed that natural events have natural causes was
   a. Aristotle.
   b. Einstein.
   c. Copernicus.
   d. Thales.
2. Isaac Newton was the scientist who discovered that
   a. Earth revolves around the sun.
   b. some elements are radioactive.
   c. objects with greater mass have a greater force of attraction.
   d. particles of matter are in constant motion.
3. Careers in physical science include
   a. pharmacist.
   b. engineer.
   c. surveyor.
   d. all of the above
4. A student did an experiment to test the hypothesis that more sugar dissolves in hot water than cold water. What is the dependent variable in the experiment?
   a. amount of water
   b. temperature of water
   c. amount of dissolved sugar
   d. amount of stirring
5. What does the following lab safety symbol represent?

   a. radioactive hazard
   b. biohazard
   c. toxic chemical hazard

d. open flame hazard

6. What is a graduated cylinder used to measure?

a. mass
b. width
c. volume
d. circumference

7. Which of the following is not a step in the technological design process?

a. develop a hypothesis
b. identify a problem
c. create a model
d. select the best solution

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Copernicus proposed that Earth is at the center of the solar system.

_____ 9. Matter refers to all the "stuff" that exists in the universe.

_____ 10. An example of a chemical change is water boiling.

_____ 11. Advances in physical science are responsible for the invention of motor vehicles.

_____ 12. The first step of a scientific investigation is gathering data.

_____ 13. Volume is an example of a derived quantity.

_____ 14. The freezing point of water on the Celsius scale is 32 degrees.

_____ 15. The evolution of modern computers began in the 1990s.

_____ 16. All technological designs have constraints.

_____ 17. Ethics is important in science but not in technology.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. A scientific _____ is a broad explanation that is supported by a great deal of evidence.

19. _____ means drawing general conclusions from many observations.

20. A scientific hypothesis is a potential answer to a question that must be _____.

21. _____ gives matter the ability to move and change.

22. The physical science that focuses on matter is _____.

23. The manipulated variable in an experiment is also called the _____ variable.

24. The total spread of values in a set of measurements is the _____.

25. A device that records ground movements caused by earthquakes is a(n) _____.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Compare and contrast scientific theories and scientific laws, and give an example of each.

27. Which two concepts are the focus of physical science? What are some specific questions relating to these two concepts that physical science might be able to answer?

28. What are similarities and differences between the technological design process and scientific investigation?

## Answer Key

1. d 2. c 3. d 4. c 5. a 6. c 7. a

8. false 9. true 10. false 11. true 12. false 13. true 14. false 15. false 16. true 17. false

18. theory 19. Induction 20. testable 21. Energy 22. chemistry 23. independent 24. range 25. seismometer

26. A scientific theory is a broad explanation that is widely accepted because it is supported by a great deal of evidence. Theories answer "why" questions. An example of a theory is the kinetic theory of matter. A scientific law is a statement describing what always happens under certain conditions in nature. Laws answer "how" questions but not "why" questions. An example of a law is Newton's law of gravity.

27. The concepts of matter and energy are the focus of physical science. Questions may vary. Sample answer: Some specific questions relating to matter and energy that physical science might be able to answer include: What happens

to the matter of a candle when it burns? How do stalactites form in caves? How does a rainbow form? How do musical instruments make sounds? How does a light bulb turn electricity into light?

28. Technological design and scientific investigation both use evidence and logic to solve problems. However, their goals are different. The goal of scientific investigation is to increase our knowledge and understanding, whereas the goal of technological design is to apply knowledge to real-world problems. There are generally limits on scientific investigations, such as money and time, just as there are constraints on technological design. Both scientific investigation and technological design also must take into account ethical considerations. The methods of scientific investigation and technological design are similar but have some important differences. For example, a scientific investigation generates and tests a hypothesis, which is a possible answer to a question, whereas the technological design process generates and tests a possible solution to a problem.

# 26.2 Unit 2: Matter Test

Unit 2 chapters: *Introduction to Matter, States of Matter, Atoms* and *Periodic Table*

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Which of the following is a physical property of matter?
    a. state of matter
    b. ability to burn
    c. ability to react chemically
    d. ability to dissolve in other substances
2. Which element is the most common element in living things?
    a. hydrogen
    b. oxygen
    c. carbon
    d. iron
3. The state of matter in which matter has a fixed volume and shape is
    a. gas.
    b. solid.
    c. plasma.
    d. liquid.
4. The nucleus of an atom contains
    a. protons.
    b. neutrons.
    c. electrons.
    d. two of the above
5. The first known person to introduce the idea of atoms as the smallest particles of matter was
    a. Dalton.
    b. Democritus.
    c. Thomson.
    d. Rutherford.
6. Bohr introduced the idea that electrons orbit the nucleus only at fixed distances called
    a. energy levels.
    b. electron clouds.
    c. orbitals.
    d. quarks.
7. From left to right across most periods of the periodic table, elements change from
    a. nonmetals to metals to metalloids.
    b. metals to nonmetals to metalloids.
    c. metalloids to metals to nonmetals.
    d. metals to metalloids to nonmetals.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Weight is a measure of the force of gravity pulling on an object.

_____ 9. Glass breaking is an example of a chemical change in matter.

_____ 10. Viscosity is a force that pulls particles at the exposed surface of a liquid toward other liquid particles.

_____ 11. As the temperature of a gas increases, its volume also increases.

_____ 12. Matter loses energy when it changes from a liquid to a gas.

_____ 13. The process in which a solid changes to a gas is called melting.

_____ 14. Different isotopes of the same element have the same atomic number.

_____ 15. Elements that are good conductors of electricity are classified as metals.

_____ 16. Boron and silicon are examples of elements that are classified as nonmetals.

_____ 17. Alkali metals are the most reactive of all metals.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. A homogeneous mixture with particles large enough to reflect light is a(n) _____.

19. The ability of matter to burn is a property called _____.

20. _____ law states the relationship between temperature and volume of a gas.

21. A liquid changes to a solid in the process of _____.

22. An atom that gains or loses electrons becomes a charged particle called a(n) _____.

23. Denser regions in an electron cloud where electrons are most likely to be are called _____.

24. Electrons in the outer energy level of an atom are called _____ electrons.

25. Highly reactive elements with seven valence electrons are called _____.

**Short Answer**

*Answer the following questions in complete sentences.*

26. A large candle has burned and all that seems to remain is a small puddle of wax. Explain how the law of conservation of mass applies to the candle.

27. Explain the relationship between the kinetic energy of particles and the state of matter.

28. Describe Dalton's atomic theory. Which parts of the theory are still accepted today? Which parts are no longer accepted? Why?

## Answer Key

1. a 2. c 3. b 4. d 5. b 6. a 7. d

8. true 9. false 10. false 11. true 12. false 13. false 14. true 15. true 16. false 17. true

18. colloid 19. flammability 20. Charles' 21. freezing 22. ion 23. orbitals 24. valence 25. halogens

26. The large candle seems to have lost mass when it burned and changed to a small puddle of wax. However, mass cannot be created or destroyed according to the law of conservation of mass. Some of the mass of the candle changed to the puddle of wax when the candle burned, but some also changed to gases that were released into the air, and this matter can no longer be observed.

27. The amount of kinetic energy of particles of matter differs when matter is in different states. Particles in solids have less kinetic energy than particles in liquids, and particles in liquids have less kinetic energy than particles in gases.

28. Dalton's atomic theory consists of three main ideas: all substances are made of atoms, and atoms are the smallest particles of matter; all atoms of the same element are alike and have the same mass, and atoms of different elements are different and have different masses; and atoms join together to form compounds, and a given compound always consists of the same kinds of atoms in the same ratio. Most of Dalton's atomic theory is still accepted today. The only part that is no longer accepted is his idea that atoms are the smallest particles of matter. Scientists now know that atoms consist of even smaller particles.

# 26.3 Unit 3: Chemical Interactions Test

Unit 3 chapters: *Chemical Bonding, Chemical Reactions, Chemistry of Carbon, Chemistry of Solutions* and *Nuclear Chemistry*

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. How many valence electrons does each hydrogen atom have?
    a. 1
    b. 2
    c. 3
    d. 4
2. The chemical formula CH4 represents the compound named
    a. carbon hydroxide.
    b. hydrogen chloride.
    c. hydrogen carbide.
    d. methane.
3. Which coefficient is missing from the following chemical equation? $2H_2O \rightarrow H_2 + O_2$
    a. 1
    b. 2
    c. 3
    d. 4
4. The form of carbon in which carbon atoms are arranged in layers is
    a. coal.
    b. graphite.
    c. diamond.
    d. fullerene.
5. Which of the following hydrocarbons is saturated?
    a. ethane
    b. benzene
    c. ethylene
    d. methyne
6. Which gas is considered the solvent in Earth's atmosphere?
    a. oxygen
    b. nitrogen
    c. water vapor
    d. carbon dioxide
7. The scientist who won Nobel prizes for discovering the radioactive elements polonium and radium was
    a. Einstein.
    b. Geiger.
    c. Curie.

d. Mendeleev.

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. When an ionic bond forms, atoms of a metal gain one or more electrons.

_____ 9. Hydrogen chloride is an example of an ionic compound.

_____ 10. A cake baking is an example of a change that involves chemical reactions.

_____ 11. A chemical equation is a symbolic representation of a chemical compound.

_____ 12. Biochemical compounds that contain nitrogen include nucleic acids and lipids.

_____ 13. All human enzymes help the body digest food by speeding up biochemical reactions.

_____ 14. A solution is any mixture of two or more substances.

_____ 15. Increasing the pressure on a gas increases its solubility.

_____ 16. A beta particle consists of two protons and two neutrons.

_____ 17. Nuclear fission begins when a nucleus captures a neutron.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. A covalent bond between two atoms of the same element is called a(n) _____ bond.

19. The general equation of a(n) _____ reaction is A + B $\rightarrow$ C.

20. A chemical reaction that releases energy is known as a(n) _____ reaction.

21. A(n) _____ is a large molecule that consists of many smaller molecules joined together by covalent bonds.

22. The amount of solute in a given amount of solution is the _____ of the solution.

23. Litmus changes from red to blue in the presence of a(n) _____.

24. The scientist who discovered radioactivity was _____.

25. The type of radioactive decay that emits only energy and no particles is called _____ decay.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Compare and contrast ionic, covalent, and metallic bonds.

27. Explain how photosynthesis and cellular respiration are related.

28. Make arguments for and against using nuclear fission for energy.

## Answer Key

1. a 2. d 3. b 4. b 5. a 6. b 7. c

8. false 9. true 10. true 11. false 12. false 13. false 14. false 15. true 16. false 17. true

18. diatomic 19. synthesis 20. exothermic 21. polymer 22. concentration 23. base 24. Becquerel 25. gamma

26. Ionic, covalent, and metallic bonds are all types of chemical bonds, which are forces of attraction between atoms or ions. An ionic bond is the force of attraction that holds together positive and negative ions. It forms when atoms of a metallic element give up electrons to atoms of a nonmetallic element. A covalent bond is the force of attraction that holds together two atoms that share a pair of electrons. The shared electrons are attracted to the nuclei of both atoms. Covalent bonds form only between atoms of nonmetals. A metallic bond is the force of attraction between a positive metal ion and the valence electrons it shares with other ions of the metal. The positive ions form a lattice-like structure. Metallic bonds form only between the atoms of metals.

27. Photosynthesis and cellular respiration are closely related. Each process can be considered the reverse of the other. Photosynthesis is the endothermic process in which carbon dioxide and water react to produce glucose and oxygen. Cellular respiration is the exothermic process in which glucose and oxygen react to produce carbon dioxide and water. The products of photosynthesis are the reactants of cellular respiration, and the products of cellular respiration are the reactants of photosynthesis.

28. Answers may vary but should include the pros and cons of nuclear fission. Pros include the fact that nuclear fission does not produce air pollution as fossil fuels do. Therefore, nuclear fission does not contribute to acid rain or global warming. Cons of nuclear fission include that it uses a nonrenewable resource (uranium) as fuel, produces dangerous nuclear waste, and poses the risk of nuclear accidents.

# 26.4 Unit 4: Motion and Forces Test

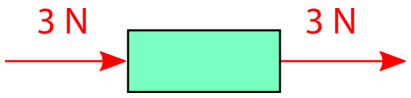
Unit 4 chapters: *Motion, Forces, Newton's Law of Motion, Fluid Forces* and *Work and Machines*

**Name**_____ **Class**_____ **Date**_____

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Motion is a vector if it includes both distance and
   a. speed.
   b. length.
   c. position.
   d. direction.
2. A bicyclist traveling on a straight road went from 0 m/s to 2m/s in 2 seconds. What was the bicyclist's acceleration?
   a. 1 $m/s^2$
   b. 2 $m/s^2$
   c. 4 $m/s^2$
   d. none of the above
3. In the sketch below, what is the net force acting on the block?




   a. 0 N to the right
   b. 3 N to the right
   c. 6 N to the right
   d. 9 N to the right
4. What determines the inertia of any object?
   a. its mass
   b. its volume
   c. friction acting on it
   d. two of the above
5. An object's velocity will change only if it is acted on by a(n)
   a. net force.
   b. strong force.
   c. moving force.
   d. unbalanced force.
6. The pressure exerted by a fluid depends on its
   a. mass.
   b. depth.
   c. density.
   d. two of the above
7. How much work does Tran do if he lifts a 100-N box to a height of 2 m above the ground?

a. 50 N/m
b. 102 N • m
c. 200 N • m
d. none of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. The slope of a distance-time graph represents speed.

_____ 9. Speed is a vector unless it is equal to zero.

_____ 10. You can stand on a sidewalk without slipping because of static friction.

_____ 11. Rolling friction is stronger than sliding friction.

_____ 12. Newton's second law of motion is also called the law of inertia.

_____ 13. The acceleration of an object equals the net force acting on the object times the object's mass.

_____ 14. When the same amount of force is exerted over a greater area, it produces greater pressure.

_____ 15. Archimedes' law states that the buoyant force acting on an object in a fluid equals the weight of the water displaced by the object.

_____ 16. A machine cannot increase the amount of work that is done.

_____ 17. When the threads of a screw are farther apart, the screw has a greater mechanical advantage.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. Acceleration is a change in speed or _____.

19. _____ was the first person to suggest that gravity affects all objects in the universe.

20. A stretched rubber band returns to its original shape when released because it has the property of _____.

21. According to Newton's _____ law of motion, forces always act in pairs.

22. An object's mass multiplied by its velocity equals its _____.

23. The upward force exerted by a fluid is known as _____ force.

24. In a(n) _____ class lever, the input and output forces are on opposite sides of the fulcrum

25. Any machine that consists of two or more simple machines is called a(n) _____ machine.

**Short Answer**

*Answer the following questions in complete sentences.*

26. Relate the concepts of force, weight, and mass.

27. Compare and contrast Newton's three laws of motion.

28. What is the efficiency of a machine, and how is it calculated? Why is the efficiency of a machine always less than 100 percent?

## Answer Key

1. d 2. a 3. c 4. a 5. d 6. d 7. c

8. true 9. false 10. true 11. false 12. false 13. false 14. false 15. true 16. true 17. false

18. direction 19. Newton 20. elasticity 21. third 22. momentum 23. buoyant 24. first 25. compound

26. A force is a push or pull acting on an object. An example of a force is gravity. Gravity has traditionally been defined as a force of attraction between two masses. According to this conception of gravity, anything that has mass exerts gravity on anything else with mass. Weight measures the force of gravity pulling on an object. On Earth, a mass of 1 kilogram has a weight of about 10 Newtons. As long as gravity is constant, as it is on Earth, weight increases as mass increases.

27. Newton's three laws of motion describe how objects move, and they identify how different factors affect motion. Newton's first law of motion states than an object's motion does not change unless the object is acted on by an unbalanced force. The second law states that the acceleration of an object equals the net force acting on the object divided by the object's mass. The third law states that every action has an equal and opposite reaction.

28. The efficiency of a machine is the percent of input work that becomes output work. It is a measure of how well a machine reduces friction. Efficiency is calculated by dividing the output work by the input work and multiplying by 100 percent. The efficiency of a machine is always less than 100 percent because a machine always must use some of the work put into it to overcome friction.

# 26.5 Unit 5: Energy Test

Unit 5 chapters: *Introduction to Energy, Thermal Energy, Waves, Sound, Radiation, Visible Light, Electricity, Magnetism* and *Electromagnetism*

**Name_____ Class_____ Date_____**

**Multiple Choice**

*Circle the letter of the correct choice.*

1. Tory throws a 0.5-kilogram rock through the air. If the rock is moving at a velocity of 2 m/s, what is its kinetic energy?
   a. 1 J
   b. 2 J
   c. 3 J
   d. 4 J
2. The thermal energy of a substance depends on the average kinetic energy of its particles and its
   a. temperature.
   b. specific heat.
   c. volume.
   d. mass.
3. Any wave that transfers energy through matter is a called a
   a. surface wave.
   b. mechanical wave.
   c. transverse wave.
   d. longitudinal wave.
4. Decibels are units that measure the
   a. speed of sound.
   b. pitch of sound.
   c. intensity of sound.
   d. amplitude of sound.
5. Electromagnetic waves include all of the following except
   a. ultraviolet light.
   b. microwaves.
   c. radio waves.
   d. ocean waves.
6. Ways of producing light without heat include
   a. fluorescence.
   b. bioluminescence.
   c. electroluminescence.
   d. all of the above
7. If you scuff rubber-soled shoes across a wool rug
   a. the rubber soles transfer electrons to the rug.
   b. the rubber soles become positively charged.

c. the rubber soles and carpet become oppositely charged.
d. none of the above

**True or False**

*Write true if the statement is true or false if the statement is false.*

_____ 8. Fossil fuels are nonrenewable resources because once they are used up no new fossil fuels can ever form.

_____ 9. The role of the refrigerant in a cooling system is to transfer thermal energy.

_____ 10. Wave speed is the number of waves that pass a fixed point in a given amount of time.

_____ 11. The middle ear increases the amplitude of sound waves as they pass to the inner ear.

_____ 12. Nothing in the universe is known to travel faster than the speed of light.

_____ 13. A convex lens can form only reduced images.

_____ 14. When there is less resistance in a circuit, more current flows through it.

_____ 15. Iron is a naturally occurring permanent magnet.

_____ 16. The magnetic field around a current-carrying wire surrounds the wire in concentric circles.

_____ 17. A solenoid consists of a coil of wire wrapped around an iron bar.

**Fill in the Blank**

*Fill in the blank with the appropriate term.*

18. _____ energy is the energy of an object that is moving or has the ability to move.

19. Energy travels from the sun to Earth by the heat transfer method of _____.

20. When a wave is reflected straight back from an obstacle, the reflected wave interferes with the original wave and creates a(n) _____ wave.

21. Changing the frequency of sound waves changes the _____ of sound.

22. Unlike mechanical waves, electromagnetic waves do not need a(n) _____.

23. Nerve cells in the retina that can sense dim light are known as _____.

24. The power of an electric device equals the current used by the device times the _____ of the circuit.

25. The present orientation of Earth's magnetic poles is called _____ polarity.

**Short Answer**

*Answer the following questions in complete sentences.*

26. What are semiconductors, what is their function, and how do they work?

27. Explain at the level of atoms how a ferromagnetic material can be magnetized.

28. Explain how electric transformers function and why they are used.

## Answer Key

1. a 2. d 3. b 4. c 5. d 6. d 7. c

8. false 9. true 10. false 11. true 12. true 13. false 14. true 15. false 16. true 17. false

18. Mechanical 19. radiation 20. standing 21. pitch 22. medium 23. rods 24. voltage 25. normal

26. Semiconductors are solid crystals consisting mainly of silicon that can conduct current better than electric insulators but not as well as electric conductors. The function of semiconductors is to conduct electric current in electronic components such as diodes, transistors, and integrated circuits. Semiconductors are the basis of each of these types of electronic components. There are two types of semiconductors: n-type semiconductors and p-type semiconductors. An n-type semiconductor is like the negative terminal in a chemical cell, and a p-type semiconductor is like the positive terminal in a chemical cell. Therefore, electrons flow from an n-type to a p-type semiconductor.

27. When electrons spin around the nucleus of an atom, the atom becomes a tiny magnet, with north and south poles and a magnetic field. In a ferromagnetic material, there are large areas where the north and south poles of atoms are all lined up in the same direction. These areas are called magnetic domains. Generally, the magnetic domains point in different directions, so the material is still not magnetic. However, the material can be magnetized by placing it in a magnetic field. When this happens, all the magnetic domains become aligned, and the material becomes a magnet.

28. Electric transformers are devices that use electromagnetic induction to change the voltage of electric current. They may either increase or decrease the voltage of the current, but they work only with alternating current. A transformer consists of two wire coils, called coil P and coil S, wrapped around an iron core. When alternating primary current passes through coil P, it magnetizes the iron core. Because the current is alternating, the magnetic field of the iron core keeps reversing. This induces alternating current in coil S, which is part of another circuit. If the two coils have different numbers of turns, the voltage of the secondary current is different than the voltage of the primary current. When coil S has more turns than coil P, the secondary current has greater voltage than the

primary current. This type of transformer is used by power plants to decrease current in power lines leaving the plants. When coil S has fewer turns than coil P, the secondary current has less voltage than the primary current. This type of transformer is used to decrease the voltage of current before it enters homes.