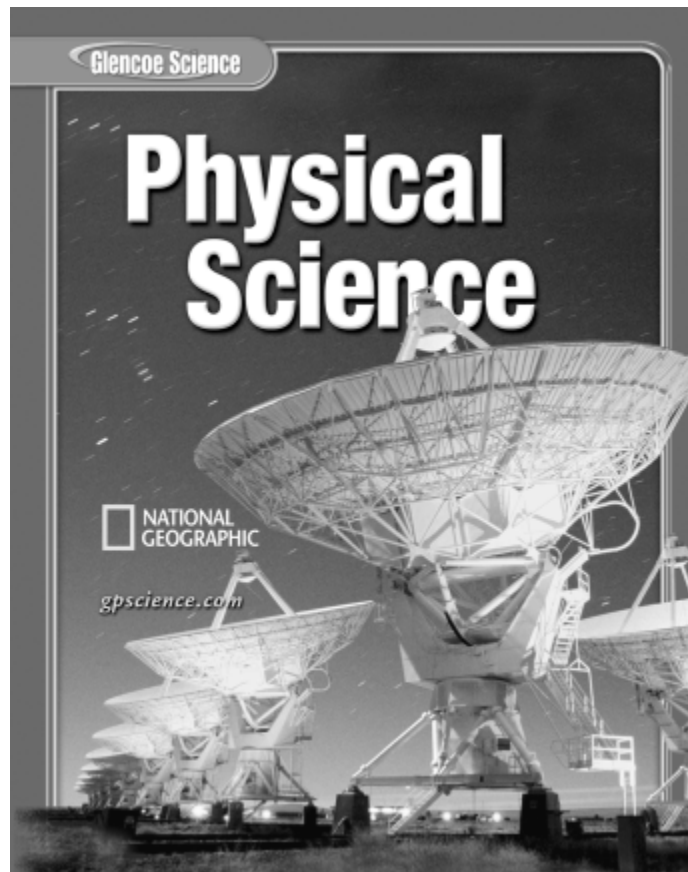


# Mastering Standardized Tests

## Student Edition



New York, New York   Columbus, Ohio   Chicago, Illinois   Peoria, Illinois   Woodland Hills, California



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# Introduction

## What is in this book?

### **Welcome to the Student Edition of *Standardized Test Practice for Glencoe Physical Science*.**

There are three distinct sections in this workbook:

- **Introduction: *Methods***

This introduction provides you with methods to tackle test questions. Using the methods in this introduction, you will learn how to use the process of elimination, how to identify important information in the tests' graphs, charts, and tables, as well as other skills that can help you succeed on tests. Carefully study the methods in this introduction before you begin the test questions in this workbook.

This workbook was written to accompany your textbook. For every chapter in your textbook, there are two types of tests in this workbook.

- **Chapter Test: *Content Mastery***

For every chapter in the textbook, this workbook contains a Chapter Test. Each Chapter Test is made up of multiple-choice questions designed to assess your knowledge and understanding of the material in the corresponding chapter of the textbook.

- **Standardized Test Practice: *Test Preparation***

For every chapter in the textbook, this workbook contains a corresponding Standardized Test Practice. The questions in this section are designed to prepare you for national science tests such as the TerraNova, the Iowa Tests of Basic Skills (ITBS), and the Stanford Achievement Test, Ninth Edition (SAT-9). The format of the questions found in these practice tests is very similar to the format of the questions found in the actual national science tests.

# Methods of Content Review and Test Preparation

A unique four-part **Task Regimen** and helpful **Test-Taking Tips** designed to maximize the benefits of using this workbook are presented in this section. Each of the four tasks is designed to help you identify challenges and improve your performance.

Each task has an assignment for you to do on your own at home and one to do in class. The homework and the in-class activities will often be coordinated, so it is important that you concentrate on both equally.

***Remember, the entire goal of this workbook is to benefit YOU!***

Before you begin this workbook, take a minute to answer the following questions. On the blank lines, write in any other questions or ideas you might have. Remember to discuss your questions with your teacher so that you can be fully informed about the test.

1. Is the standardized test timed, or will I have unlimited time?

---

2. Am I allowed to write on the test? If not, do I need to bring scratch paper?

---

3. Where will the test be held? Is it in a room that tends to be cold, and should I bring a sweater?

---

- 4.

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- 5.

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# Task Regimen

## Task I

**Objective:** To use the Chapter Tests to review science material from your textbook

**At-Home Goal:** To identify parts of the textbook you need to review further

**In-Class Goal:** To receive explanations about details from the textbook chapter and help with content that you need to review further

### Task I

#### At-Home Assignment

For each question you missed in the Chapter Test, find the pages in the textbook that cover the material.

If you cannot find the information, write out three questions about the material that you did not understand.

#### In-Class Assignment

Work in a group to review the textbook material and the missed questions.

#### How It Will Help You

By receiving personal attention, you will be able to have all of your specific questions answered and explained.

Reviewing the missed questions will help you make sure that you understand your mistakes.

#### Example 1

Which type of wind generally moves from the southwest to the northeast in the northern hemisphere?

- f. polar easterlies
- g. jet stream
- h. sea breeze
- j. prevailing westerlies

Note the page in the textbook where this information can be found.

# Task II

**Objective:** To use the Standardized Test Practices as preparation for actual standardized tests

**In-Class Goal:** To practice working on test-like questions in a realistic test-taking environment

**At-Home Goal:** To analyze your mistakes and identify any questions you need to work on

## Task II

### In-Class Assignment

Take the test in a realistic test-taking environment.

### At-Home Assignment

With an answer key from your teacher, review your test. Using your textbook, review any incorrect answers. Put a question mark beside any questions that you cannot figure out and bring them to class the next day.

### How It Will Help You

This assignment will help you carefully analyze your mistakes and identify the exact reason you answered some questions incorrectly. You will also receive help with questions you need to review.

### Example 2

Test	Element 1	Element 2	Element 3	Element 4
Conductivity	Yes	Yes	No	No
Physical appearance	Shiny solid stored in oil	Shiny solid	Colorless gas	Yellow gas
Reactivity	Very reactive	Reacts with non-metals	Unreactive	Reacts with alkali metals

A fifth element also was tested. It did not conduct, it reacted with alkali metals, and it was a gas. This element behaved most similarly to

- F Element 1
  - G Element 2
  - H Element 3
  - J Element 4
- Carefully consider the information in the table. None of these elements reacts with alkali metals **and** is a gas. Therefore, all of these answer choices are incorrect.

Carefully consider the information in the table again. Only Element 4 reacts with alkali metals and is a gas.



## Task III

**Objective:** To use the process of elimination during testing situations

**At-Home Goal:** To practice using the process of elimination to identify incorrect answer choices

**In-Class Goal:** To strengthen your use of the process of elimination

### Task III

#### At-Home Assignment

Make a list of the hardest questions and consider each answer choice. Note whether you think each answer choice is correct or incorrect and why. Place a line through the letter of each answer choice that you eliminate. Put a question mark next to any answer choices that you are not certain about. Feel free to use the textbook when needed.

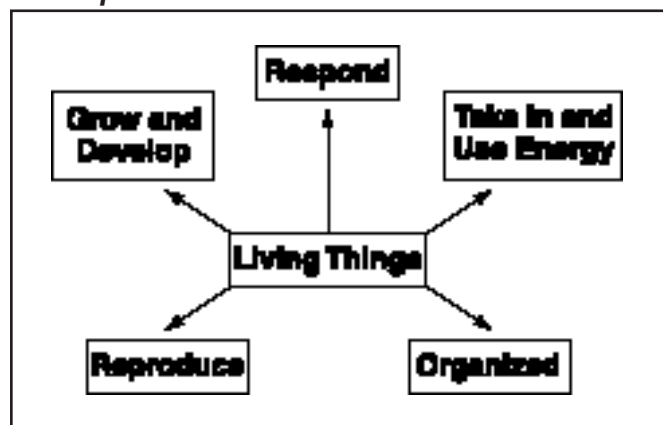
#### In-Class Assignment

Your teacher will lead a discussion about the answer choices for each question. Share your ideas and analysis with the class.

#### How It Will Help You

Working alone and as a class will give you a chance to learn and practice the process of elimination. You will learn how to successfully eliminate incorrect answer choices.

#### Example 3



Which of these statements is correct?

- F Rocks grow and develop from energy.
- G Energy uses living things.
- H Trees respond to the wind.
- J Young animals grow into mature animals.

Choice F: No, rocks do not grow. They do not use energy.

Choice G: No, living things use energy. Energy does not use living things.

Choice H: No, trees move in the wind, but it is not a response.

Choice J: Yes, young animals do grow and develop into mature animals.

# Task IV

**Objective:** To develop the ability to recognize, extract, and use all information given within the test

**At-Home Goal:** To learn how to recognize and use all of the information given to you in the questions

**In-Class Goal:** To share ideas and techniques for use all of the information given to you in the questions

## Task IV

### At-Home Assignment

Write a list of the hardest questions. For each question, write down all of the information given by the graphic and the question. Note what information helped you answer the question correctly. Write a question mark beside any question or graphic that you found confusing.

### In-Class Assignment

As a class or in groups, discuss each question. Write down a list of all the informative observations you and your peers make.

### How It Will Help You

Practicing understanding charts and graphs and analyzing the information provided by the test will help you to answer the questions correctly.

### Example 4

#### Precipitation Amounts

Month	Precipitation (cm)
March	10.63
April	11.47
May	14.68
June	9.32
July	5.87
August	4.99

→ The chart shows how much precipitation there was for each month. There are different amounts for each month.

According to the chart, which month had the LEAST precipitation?

- f. March
- g. May
- h. June
- j. August

→ August was the month with the least precipitation. This is the correct answer choice.

# Test-Taking Tips

## ***Test-Taking Tips for Before the Test:***

1. Be sure to get plenty of sleep the week before the test. A healthy amount of sleep is 8–9 hours every night.
2. The night before the test, try to do something relaxing but stimulating, such as playing a board game, exercising, or reading an enjoyable book. Cramming the night before the test can often hamper your memory and make you tired.
3. The morning of the test, eat a healthy breakfast with fresh foods that are high in protein and carbohydrates.
4. The morning of the test, clear your mind of any outside distractions so that you will be better able to focus on the test. If breaks are given during the test, use that time to relax and clear your mind.

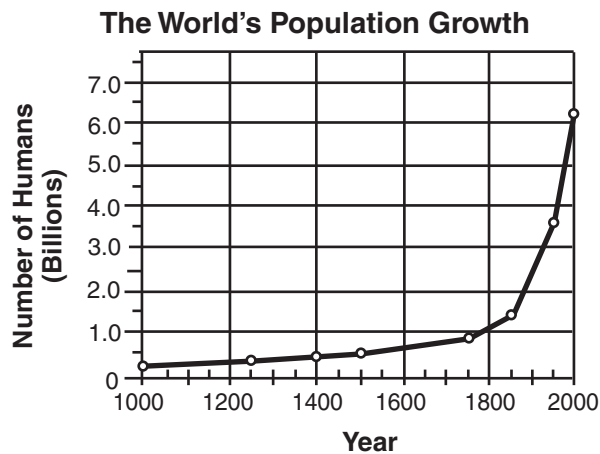
## ***Test-Taking Tips for During the Test:***

1. Listen to and read all directions.
2. Be sure you understand the question before reading the answer choices. Then, make sure to read and consider **every** answer choice.
3. Remember to carefully consider all the information presented in the test's graphics.
4. If the test is timed, be sure to pace yourself.
5. Always choose an answer. By eliminating as many incorrect choices as possible, you will have a good chance of guessing correctly and obtaining more points.

**DIRECTIONS**

Choose the best answer choice for each of the following questions.

- |  |  |
|--|--|
| <p>1. Which of the following features should NOT be included in the scientific process?</p> <ol style="list-style-type: none"> <li>hypothesis formation</li> <li>experimenter bias</li> <li>observation</li> <li>theory development</li> </ol> | <p>2. All of the following are standard components of the experimental process EXCEPT _____.</p> <ol style="list-style-type: none"> <li>models</li> <li>controls</li> <li>variables</li> <li>opinions</li> </ol> |
|--|--|



3. The best conclusion to draw from these data is that the population of the world is \_\_\_\_\_.
- decreasing
  - staying about the same
  - growing at a constant rate
  - increasing exponentially

4. Life science is the study of living things. According to this definition, a life scientist would most likely study \_\_\_\_\_.
- f. weather changes
  - g. magnetic force of different metals
  - h. cave formation
  - j. cellular reproduction
5. All of the following quantities have derived units in the SI system EXCEPT \_\_\_\_\_.
- a. volume
  - b. density
  - c. mass
  - d. pressure
6. In general, models benefit scientific investigation the most by —
- f. using derived units as measurements
  - g. representing ideas, events, and objects
  - h. changing experimental results
  - j. providing descriptions of patterns in nature
7. Under which heading in a table of contents would the most information about units be found?
- a. Dependent Variables
  - b. History of Lord Kelvin
  - c. Scientific Law
  - d. Measurement Systems
8. In the laboratory, chemicals that you are finished working with should be \_\_\_\_\_.
- f. mixed together and dumped into a designated container
  - g. returned to their original containers
  - h. poured into the sink
  - j. disposed of as directed by your teacher
9. To determine the boiling point of an unknown liquid, a student heats 10 mL of the liquid in a test tube and records the temperature every minute for 20 minutes. In this example, time is the \_\_\_\_\_.
- a. control
  - b. dependent variable
  - c. independent variable
  - d. hypothesis
10. Melissa heated a few blue crystals in a test tube. After a few minutes, she observed that the crystals had turned white and a film of water had formed on the inside of the test tube. Before Melissa conducted this experiment, she most likely \_\_\_\_\_.
- f. developed a theory
  - g. developed a hypothesis
  - h. developed a bias
  - j. developed a scientific law



**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

**1** In science, activities are performed that test the validity of theories. These activities are called

- A** experiments
- B** hypotheses
- C** variables
- D** controls

**2** Sometimes scientists misinterpret their data, causing them to draw the wrong conclusions. What is one common cause of scientific misinterpretation?

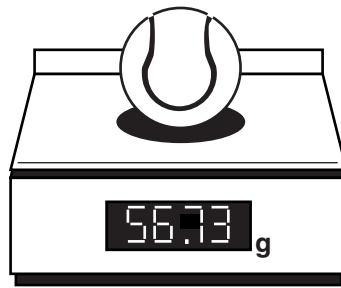
- F** unit conversion
- G** modeling
- H** researcher bias
- J** phenomenon

**3** Which of the following is the best application of a line graph?

- A** to make observations and gather information
- B** to show trends and how the data changes over time
- C** to show how some fixed quantity is broken down into parts
- D** to compare information collected by counting

**4** Which of these unit systems is used by scientists?

- F** foot-pound
- G** British
- H** Norwegian
- J** SI



**5** Mr. Alicea's class is measuring the density of a tennis ball. What additional information do the students need to find the ball's density?

- A** mass
- B** temperature
- C** volume
- D** weight

**6** Which of the following is measured in kilograms?

**F** temperature

**G** length

**H** mass

**J** speed

**7** Jeb has decided to start an aquarium. At the pet store, Jeb learns that every aquarium should be comprised of a certain percentage of different things, such as water, rocks, plants, and filters. Which of these would be the best way to illustrate the information about what aquariums should contain?

**A** table

**B** circle graph

**C** bar graph

**D** line graph

**Directions:** Read Numbers 8–9 below. Then, on the lines that follow, write your answers in complete sentences.

**8** A statement is scientific if it is testable. Write a scientific statement about something in your classroom.

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**9** “Science” and “technology” are words that often are mixed up, even though they have different meanings. Science is the process of finding new information about the world, while technology is using that scientific information to make new products. Think of something you use every day. Write one sentence about the technology used to make that object and another sentence describing the science behind the technology.

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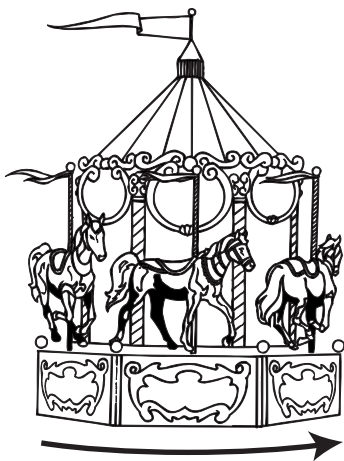


**DIRECTIONS**

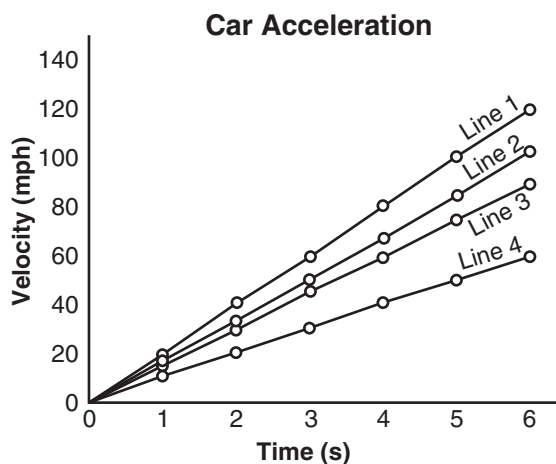
Choose the best answer choice for each of the following questions.



1. What is probably being measured in the diagram above?
  - a. speed
  - b. engine temperature
  - c. rate of tire wear
  - d. gasoline mileage

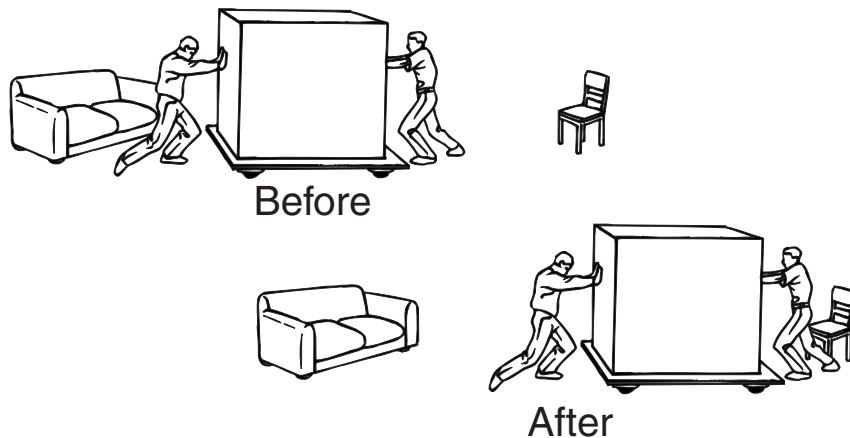


2. The horses on this carousel are accelerating because \_\_\_\_\_.
  - f. the speed of the horses is constantly increasing
  - g. the speed of the horses is constantly decreasing
  - h. the direction of the horses' motion is constantly changing
  - j. the travel time is different for every ride



3. The graph above represents the change in velocity of four cars over a period of 6 seconds. Which line represents the car with the greatest acceleration?
  - a. 1
  - b. 2
  - c. 3
  - d. 4





4. The pictures show a large box being pushed in opposite directions by two men. The box changed its position in the room because \_\_\_\_\_.
- the opposing forces were balanced
  - the smooth floor created no friction
  - the man on the left side applied more force than the man on the right side
  - the man on the right side applied more force than the man on the left side
- 
5. Instantaneous speed is the rate of motion at an instant in time. Based on this statement, a reasonable conclusion is that if an object's instantaneous speed does not change over time, then \_\_\_\_\_.
- the object is quickly speeding up
  - the object is very gradually slowing down
  - the object is moving at a constant speed
  - the object has returned to its beginning position
6. Felicia wanted to pull out a particular issue from a pile of magazines. First, she tried pulling slowly, and the whole pile began to move. Then she tried pulling quickly, and the issue she wanted came out without the pile moving. The pile did not move when she pulled quickly because of the \_\_\_\_\_.
- smooth surface of the magazines
  - inertia of the pile and friction
  - larger force Felicia applied
  - friction between the magazines



**Standardized Test Practice** Chapter 2 *Motion*
**DIRECTIONS**

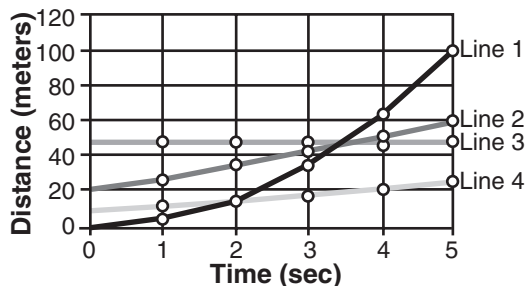
Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

- 1** Which of these is measured in meters per second per second ( $m/s^2$ )?

**A** speed  
**B** velocity  
**C** acceleration  
**D** displacement

- 2** A group of students is playing tug-of-war. The students on both sides of the rope are pulling with equal force. This is an example of

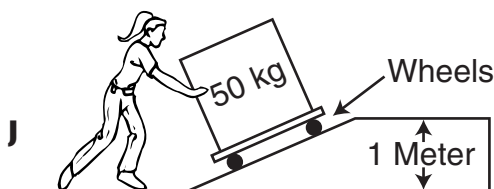
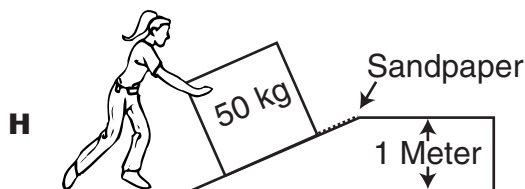
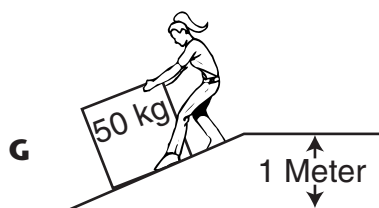
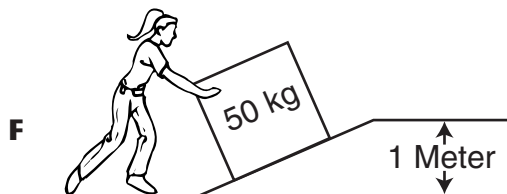
**F** unbalanced forces  
**G** displacement  
**H** acceleration  
**J** balanced forces



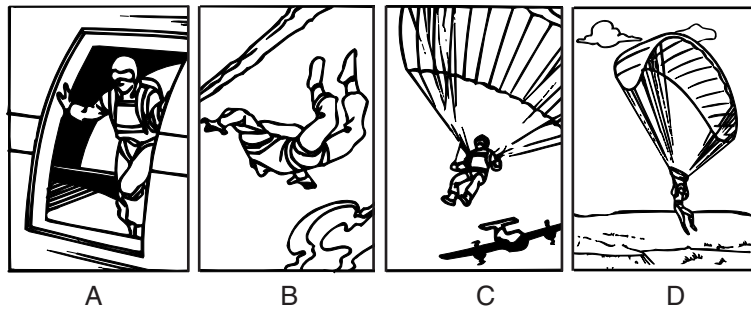
- 3** The graph above shows the distance traveled by four objects over a period of 5 seconds. Which line on the graph represents an object that is accelerating?

**A** 1  
**B** 2  
**C** 3  
**D** 4

- 4** Which of these would allow a box to be moved up a ramp with the least amount of force?



- 5** Sometimes, people mistakenly state that velocity and speed are the same thing. People might make such a mistake because they forget that velocity describes both speed and
- A** volume
  - B** force
  - C** the time interval
  - D** direction
- 6** Which of the following is not an example of unbalanced forces acting on an object?
- F** an acorn falling from a tree
  - G** a car moving at a constant speed of 55 miles per hour
  - H** a motorcycle changing speed from 50 miles per hour to 70 miles per hour
  - J** a truck slowing down as it approaches a red light

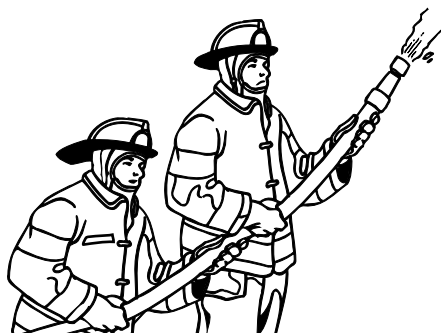


- 7** The diagram shows a skydiver at different points of her jump. At what point would her acceleration be greatest?
- A** A
  - B** B
  - C** C
  - D** D



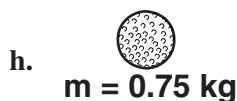
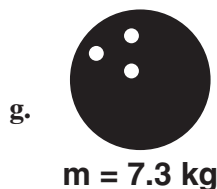
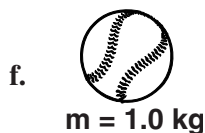
**DIRECTIONS**

Choose the best answer choice for each of the following questions.



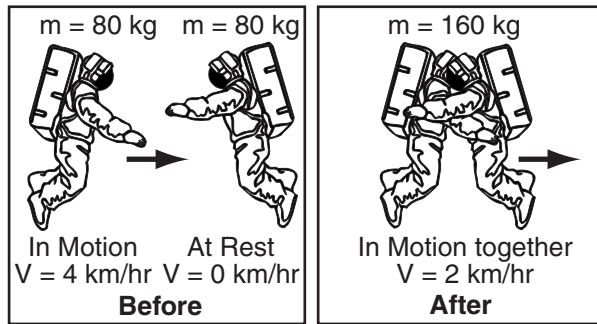
1. The firefighter feels the hose pushing backwards. What is the most likely cause of this?
  - a. The hose material is very elastic.
  - b. Since the hose is at rest, it tends to stay at rest.
  - c. The force exerted on the water equals the mass of the water times its acceleration.
  - d. The escaping water exerts an equal and opposite force on the hose.

2. If the same force is applied to each of these balls, which one will have the LEAST acceleration?

**Different Kinds of Friction**

	No Friction	Static Friction	Sliding Friction	Rolling Friction
Weight of Object	Ideal Force Needed to Push Up Ramp	Force Needed to Start Moving	Force Needed to Keep Moving	Force Needed to Keep Rolling
480 N	160 N	192 N	178 N	166 N
900 N	300 N	360 N	333 N	310 N
750 N	250 N	300 N	278 N	259 N

3. A ramp is 3 meters long and 1 meter high. Under ideal conditions, this ramp would reduce the force needed to raise an object by a factor of three. However, friction is a force that opposes motion between two surfaces that are touching. According to the chart, which kind of friction opposes motion with the greatest force?
  - a. No friction
  - b. Static friction
  - c. Sliding friction
  - d. Rolling friction

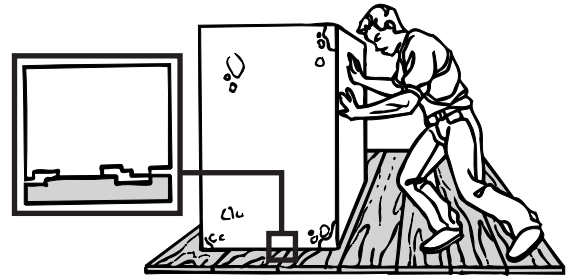


4. According to the diagram, which statement best describes what happens when two astronauts collide in space?
- Their force increases.
  - Their velocity increases.
  - Their momentum is conserved.
  - Their momentum increases.

**Distance for Free Fall**

Time (sec)	Distance (m)
0	0
1	4.9
2	19.6
3	44.1
4	78.4
5	122.5

5. The table shows the total vertical distance a free-falling body travels for each second it falls. About how far does the free-falling body travel between 4 and 5 seconds?
- 44 m
  - 54 m
  - 144 m
  - 154 m

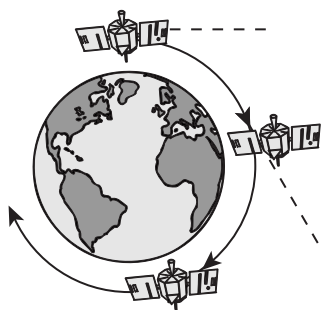


6. The man applies a force to the box, but the box does not move. The force of friction is acting on the box to cancel the force of his push. What is the most likely cause of this friction?
- The floor is not polished to a smooth finish.
  - The box is too heavy for a single person to push across the floor.
  - The uneven surfaces of the box and the floor are sticking together.
  - The man is not pushing the box with enough force.



**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.



**1** Which of these keeps the satellite moving in a circular orbit?

- A** centripetal force
- B** friction
- C** the gravity of the satellite
- D** inertia

**2** Which of these is measured in newtons?

- F** acceleration
- G** mass
- H** momentum
- J** weight

**3** Momentum equals mass times velocity ( $p = mv$ ). Which of these would have the least momentum?

- A** 1,400 kg car moving at 15 meters per second
- B** 0.035 kg bullet moving at 1,200 meters per second
- C** 16 kg greyhound moving at 25 meters per second
- D** 1.0 kg baseball moving at 38 meters per second

**4** Which statement provides the best description of terminal velocity?

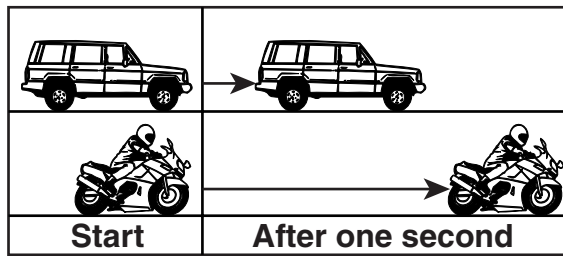
- F** Terminal velocity is the last velocity of an object recorded by a scientist.
- G** A skydiver never reaches terminal velocity.
- H** Terminal velocity is the highest velocity that a falling object will reach.
- J** Terminal velocity is the velocity a skydiver reaches just before touching the ground.

**5** A jet fighter plane taking off from an aircraft carrier goes from 0 to 70 meters per second in 2 seconds. Its acceleration would most likely be measured in

- A** kilogram meters per second
- B** meters per second
- C** meters per second per second
- D** newtons

**6** The biggest problem with driving a car that has worn-out tires is that the tires might

- F** reduce gas mileage
- G** not produce enough friction to stop the car
- H** cause a bumpy ride
- J** increase the car's momentum



**7** Which scientific law does the diagram represent?

- A** law of gravity
- B** Newton's first law of motion
- C** Newton's second law of motion
- D** Newton's third law of motion



**8** As the skydiver falls to Earth, her parachute helps her land safely by

- F** increasing air resistance
- G** acting like a helium-filled balloon
- H** warming the surrounding air
- J** blocking the Sun's rays

**Directions:** Read Number 9 below. Then, on the lines that follow, write your answer in complete sentences.

**9** Explain how weightlessness happens in a space shuttle orbiting Earth.

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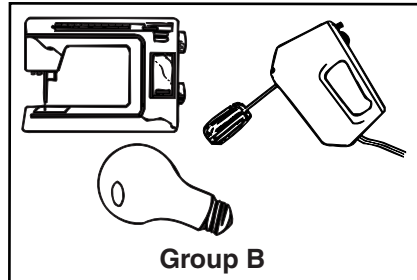
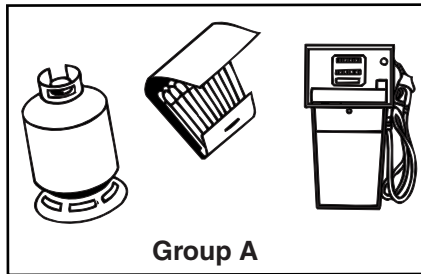


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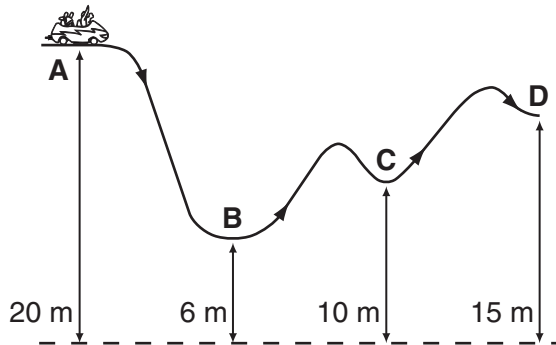


**DIRECTIONS**





Choose the best answer choice for each of the following questions.



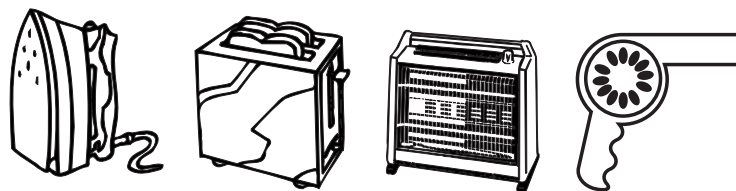
- The objects in Group A are different from the objects in Group B because only the objects in Group A \_\_\_\_\_.
  - are electrical appliances
  - have chemical potential energy
  - convert electrical energy to mechanical energy
  - are fossil fuels



- In the diagram above, a roller coaster car starts from rest at point A and moves along the track. At which point does the roller coaster car have the greatest kinetic energy?
  - A
  - B
  - C
  - D

- Air resistance is a form of friction that makes a moving object slow down. Which of these drawings shows a skier whose shape would allow him or her to move through the air with the LEAST resistance?
  - 
  - 
  - 
  - 





4. What energy change do these appliances have in common?
- They convert electrical energy to heat energy.
  - They convert electrical energy to mechanical energy.
  - They convert mechanical energy to electrical energy.
  - They convert heat energy to electrical energy.

### Nutrition Facts

Serving Size 1.5 oz.  
(42g/About 1/3 package)  
(About 1 cup cooked)  
Servings Per Container about 3

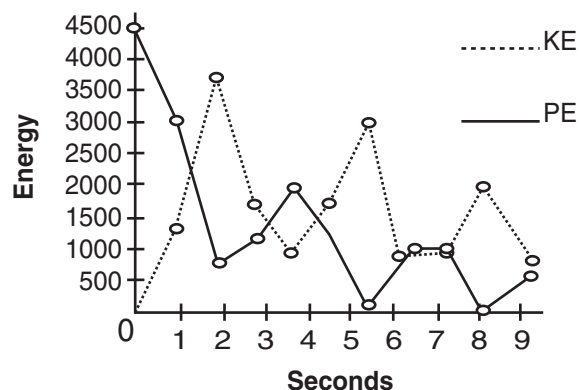
**Amount Per Serving**  
**Calories 160**      **Calories from Fat 25**

**% Daily Value\*\***

<b>Total Fat</b> 3g	5%
Saturated Fat 1.5g	8%
<b>Cholesterol</b> 5mg	2%
<b>Sodium</b> 870mg	36%
<b>Total Carbohydrate</b> 26g	9%
Dietary Fiber 1g	4%
Sugars 4g	
<b>Protein</b> 7g	

5. If Jessica were to eat two servings of this food, about how many Calories of energy would she take in?
- 160 Cal
  - 25 Cal
  - 320 Cal
  - 50 Cal

Energy of a Bouncing Ball



6. The graph shows the kinetic energy (KE) and potential energy (PE) of a bouncing ball over a period of 9 seconds. A reasonable hypothesis based on these data is that as the kinetic energy decreases, \_\_\_\_\_.
- the ball will stop bouncing
  - the potential energy will remain unchanged
  - the potential energy will also decrease
  - the potential energy will increase

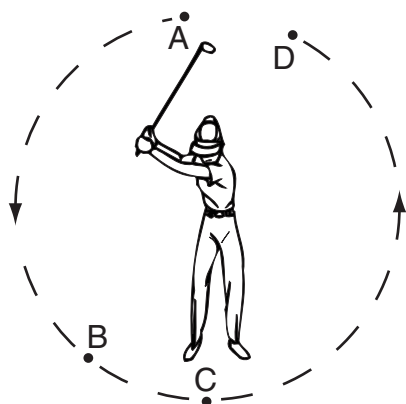


**Standardized Test Practice** Chapter 4 *Energy*
**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

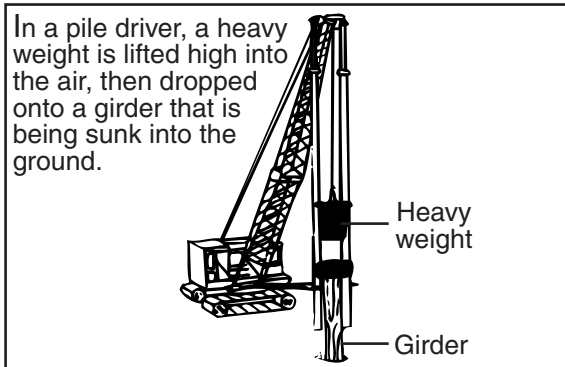
**1** Which of these is the reason that using electrical energy from a wall outlet located in the bathroom can be extremely dangerous?

- A** A wet electrical appliance can blow a fuse.
- B** Moisture can cause some electrical appliances to emit harmful fumes.
- C** Contact with water and an electrical appliance can cause a fatal shock.
- D** Dampness can cause some electrical appliances to produce toxic wastes.



**2** The diagram shows a person swinging a golf club from point A to point D. The kinetic energy of the golf club would be greatest at

- F** point A
- G** point B
- H** point C
- J** point D

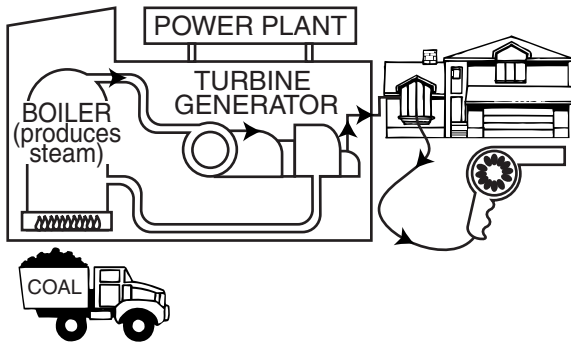


**3** A scientist wanted to calculate the gravitational potential energy of a pile driver using the formula  $GPE = \text{weight} \times \text{height}$ . The scientist measured the height, in meters, from which the pile driver was dropped. The weight was most likely measured in

- A** newtons
- B** pounds
- C** tons
- D** kilograms

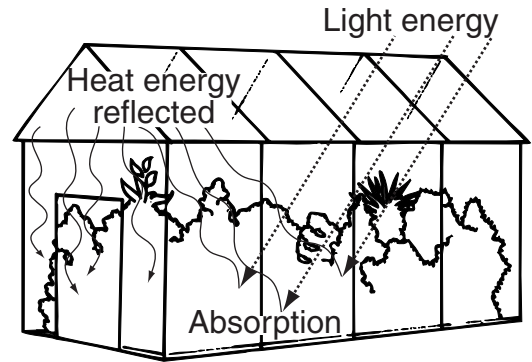
**4** Workers in factories must periodically grease the wheels and gears in machinery in order to

- F** decrease efficiency
- G** slow them down
- H** increase energy usage
- J** decrease friction



- 5** Based on the diagram above, which of the following is the correct sequence of energy changes needed to produce energy for the hair dryer?

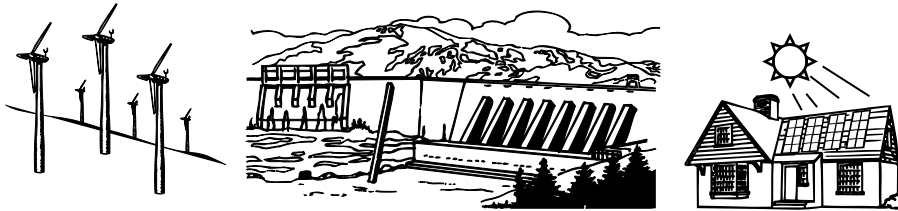
**A** Heat → Mechanical → Chemical → Electrical  
**B** Chemical → Heat → Mechanical → Electrical  
**C** Electrical → Mechanical → Heat → Chemical  
**D** Chemical → Mechanical → Heat → Electrical



- 6** The temperature is higher inside a greenhouse than outside because of the conversion of

**F** light energy into thermal energy  
**G** heat energy into light energy  
**H** nuclear energy into thermal energy  
**J** electrical energy into thermal energy

**Directions:** Read Number 7 below. Then, on the lines that follow, write your answer in complete sentences.



- 7** The burning of fossil fuels, such as coal, oil, and natural gas, generates most of the world's electricity. Burning fossil fuels is a major cause of air pollution. The world's supply of fossil fuels is limited. Three alternative methods for generating electricity are pictured above. Explain the similarities and differences among these methods.

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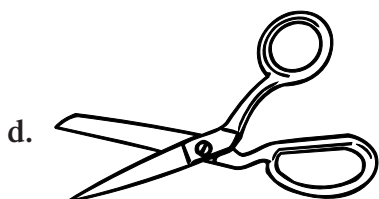
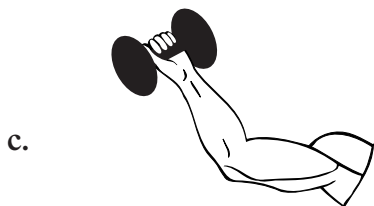
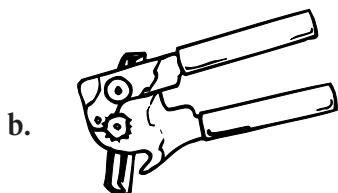
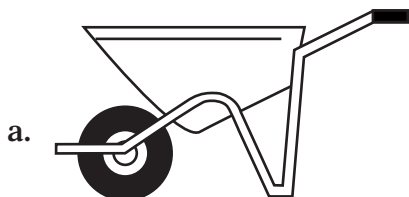
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**DIRECTIONS**

Choose the best answer choice for each of the following questions.

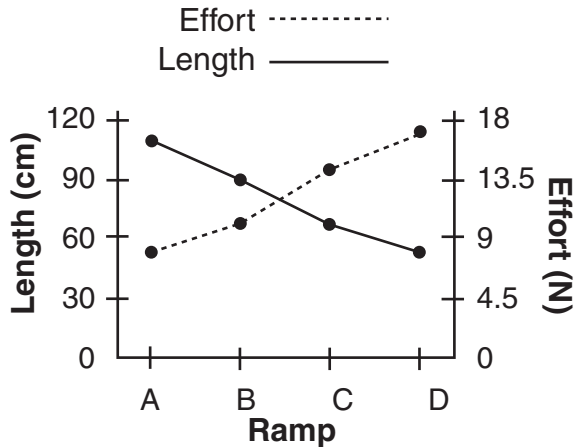
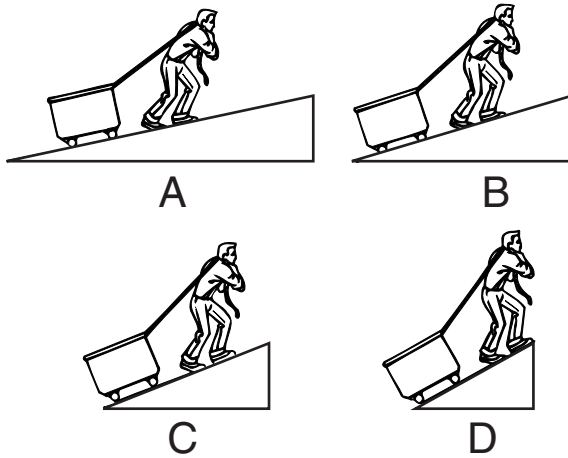
1. In a third-class lever, the effort force is applied between the fulcrum and the resistance. According to this definition, which of these is a third-class lever?



2. Using a jack, Sonia is able to raise a 15,000 newton car off the ground with a force of 500 newtons. What is the mechanical advantage, or the ratio of the resistance force to the effort force, of the jack?
- 2 to 1
  - 10 to 1
  - 15 to 1
  - 30 to 1

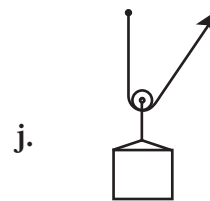
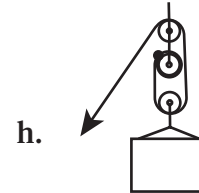
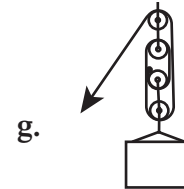
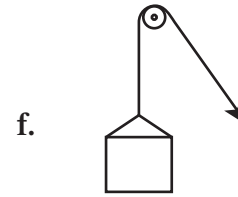
Surface	Resistance	Effort
Polished wood	20N	6.5N
Sandpaper	40N	20N
Oil on wood	50N	15N
Plain wood	30N	10N

3. The table shows an experiment used to find out how the surface of an inclined plane affects the effort force needed to move an object up the plane. Which of the following would make this a better-designed experiment?
- record the temperature of the room
  - use the same size resistance for each surface
  - put wheels on the boxes
  - record the time of day
4. The efficiency of a machine is a measure of how much of the work put into a machine is converted to useful output work by the machine. What causes the efficiency of a machine to be always less than 100 percent?
- friction
  - poor design
  - limited strength of the user
  - elastic limit of the parts



5. The graph shows the length and effort force for the four inclined planes pictured above. A reasonable hypothesis based on these data is that as the length of the inclined plane decreases, \_\_\_\_\_.
- the amount of work done decreases
  - the mechanical advantage increases
  - the effort force required decreases
  - the effort force required increases

6. Which pulley system would require the LEAST amount of effort to lift the weight?



7. What is the most likely reason that a carpenter might put a thin coat of oil on the blade of a saw before cutting wood?
- to soften the wood
  - to reduce friction
  - to stain the wood
  - to waterproof the blade

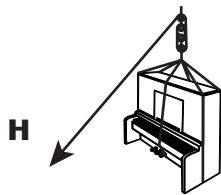
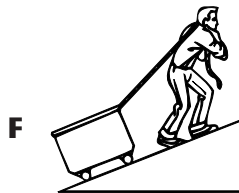
**Standardized Test Practice** Chapter 5 *Work and Machines*
**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

**1** Which of these is measured in watts?

- A** force
- B** weight
- C** power
- D** work

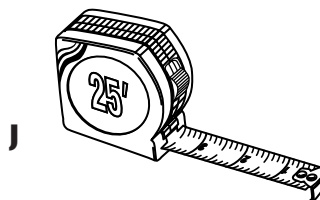
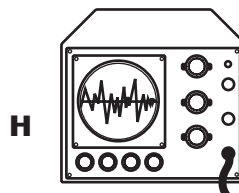
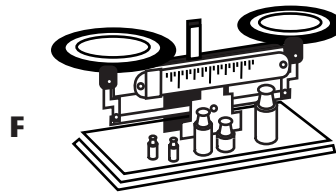
**2** Which of these diagrams shows a lever being used to do work?

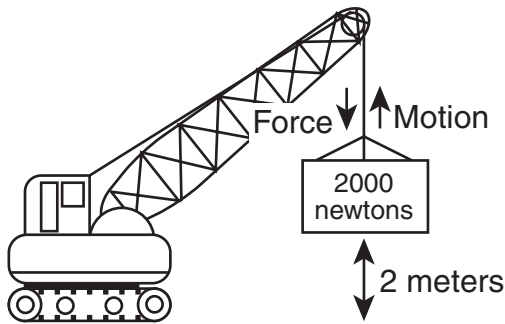


**3** On a bicycle, the wheels are wheels and axles, the handbrakes and gearshift are levers, and the chains are pulleys. Combinations of two or more simple machines are called

- A** third-class levers
- B** block and tackles
- C** complex devices
- D** compound machines

**4** Which of the following instruments would best measure the force applied to a rope pulling an object up a ramp?





- 5** The work done by the crane was most likely measured in
- A** joules
  - B** meters
  - C** newtons
  - D** watts
- 6** Which statement best describes the efficiency of a simple machine?
- F** Efficiency is the applied force times the distance through which it is applied.
  - G** Efficiency is the rate at which work is done.
  - H** Efficiency is the comparison of work output to work input.
  - J** Efficiency is the weight of an object times the distance it is moved.

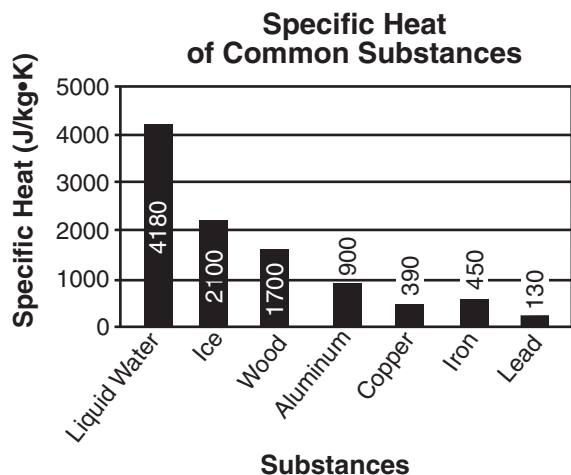


- 7** The person in the picture used a shovel to move 1,100 newtons of snow a distance of 2 meters in 15 minutes. The snowplow moved the same amount of snow the same distance in one-half of a minute. The most likely cause of this difference in time is that
- A** the snowplow did more work
  - B** the person moved the snow a smaller distance
  - C** the snowplow used more power
  - D** the person did less work
- 8** Which of the following is the reason that increasing distance can make work seem easier?
- F** As a result, the amount of friction is decreased.
  - G** As a result, the efficiency of the machine increases.
  - H** As a result, the amount of force can be decreased.
  - J** As a result, the amount of time can be decreased.

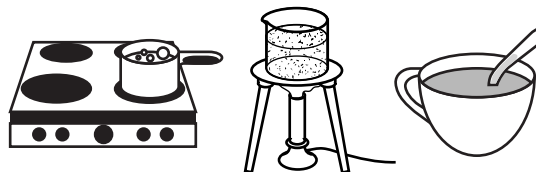


**DIRECTIONS**

Choose the best answer choice for each of the following questions.



- The specific heat of a substance is the amount of energy required to raise the temperature of 1 kilogram of that substance 1 kelvin. A reasonable hypothesis based on the data in the graph is that \_\_\_\_\_.
  - water requires the least amount of energy to raise its temperature 1K
  - lead requires more energy than ice to raise its temperature 1K
  - metals require more energy than nonmetals to raise their temperatures 1K
  - metals require less energy than nonmetals to raise their temperatures 1K



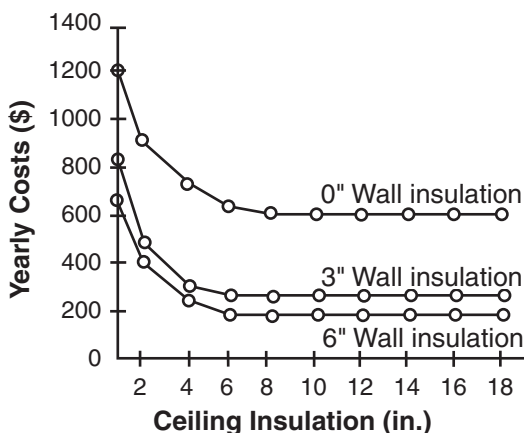
- Which process is taking place in all three pictures?
  - conduction
  - boiling
  - radiation
  - insulation

**Energy Sources Over Time**

	1880	1930	1980
Coal	20%	57%	20%
Gas	0%	10%	26%
Oil	0%	14%	46%
Nuclear	0%	0%	3%
Wood	80%	19%	0%
Other	0%	0%	5%

- According to the chart, between 1880 and 1980, which energy source went from supplying the largest percentage of energy to the smallest percentage?
  - coal
  - gas
  - oil
  - wood





4. The graph shows the yearly cost of heating a home in the northeastern part of the United States. A reasonable hypothesis based on these data is that if the insulation in the walls is thicker, then \_\_\_\_\_.
- the yearly cost of heating a home goes down
  - the thickness of the ceiling insulation has no effect
  - the yearly cost of heating a home does not change
  - more heat will escape to the outside of the home
5. Convection is the transfer of energy by the motion of the heated particles in a fluid. According to this information, which statement best describes an example of convection?
- a shirt heated by an iron
  - a puddle of rainwater heated by sunlight
  - a dark-color car heated by sunlight
  - warm air rising in the atmosphere

	Brass	Lead	Aluminum
Mass of calorimeter			
Mass of calorimeter and water			
Mass of water			
Mass of metal			
Water's starting temperature			
Metal's starting temperature			
Water's final temperature			
Metal's final temperature			
Temperature change of water			
Temperature change of metal			

6. This chart would most likely be used during an experiment designed to answer which of these questions?
- Can water cool off different metals?
  - Which metal reacts most with water?
  - How can the specific heat of different metals be calculated?
  - Is the energy contained in heated metals able to boil water?



**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

**Energy Efficiency of Different Heating Systems**

Method of Heating	Efficiency (%)
Electric Heat from Coal-Burning Plant	25
Electric Heat from Nuclear Plant	14
Natural Gas-Burning Furnace	84
Oil-Burning Stove	53
Wood-Burning Stove	26

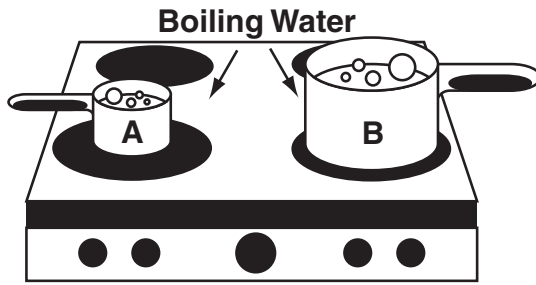
- 1** Which of these statements is true?
- A** Most of the energy produced by burning natural gas is wasted.
  - B** Oil-burning furnaces are the most energy-efficient method of heating.
  - C** Heating with electricity produced by a nuclear plant is the least energy-efficient method.
  - D** It would save money and the environment if everyone used wood-burning stoves.

**2** Ms. Markas takes a Thermos bottle filled with hot coffee to work each day. The Thermos bottle keeps the coffee hot by

- F** using a battery-powered heating element
- G** collecting solar heat energy
- H** recirculating hot air inside
- J** slowing heat transfer

**3** Which of the following is not a method by which heat energy is transferred from a warmer object to a cooler one?

- A** conduction
- B** convection
- C** insulation
- D** radiation



- 4** Which statement about the figure is correct?
- F** Pot A has a higher temperature than Pot B.
  - G** Pot B has a higher temperature than Pot A.
  - H** Pot A has more thermal energy than Pot B.
  - J** Pot B has more thermal energy than Pot A.

- 5** Adam placed a heated aluminum cube in a beaker of water and then measured the change in the temperature of the water. The change in temperature he recorded was most likely measured in

- A** calories
- B** degrees Celcius
- C** grams per cubic centimeter
- D** joules

**Directions:** Read Numbers 6 and 7 below. Then, on the lines that follow, write your answers in complete sentences.

- 6** Our supply of fossil fuels, such as coal, oil, and natural gas, is dwindling. Discuss the pros and cons of using nuclear energy. Suggest some alternate methods of energy production.

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- 7** Kichu has noticed that he feels hotter on humid days than on dry days even when the temperatures are the same. Explain why this happens.

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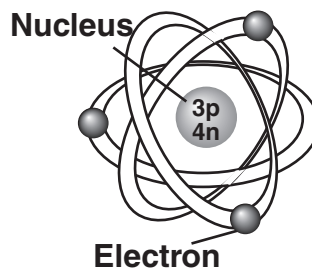
**DIRECTIONS**

Choose the best answer choice for each of the following questions.

**Air Conditioner Energy Guide**

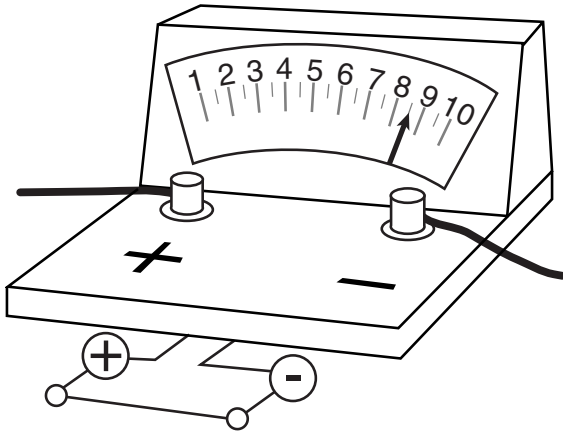
Cost per Kilowatt hour	Hours of Use/Year			
	250	1000	2000	3000
6 ¢	\$10	\$40	\$79	\$119
8 ¢	\$13	\$53	\$106	\$158
10 ¢	\$16	\$66	\$132	\$198
12 ¢	\$20	\$79	\$158	\$238

- According to the label, what is the estimated cost of running this air conditioner for 3,000 hours if electricity costs 10 cents per kilowatt-hour?
    - \$40
    - \$198
    - \$238
    - \$300
- 
- Electrical wires sometimes have a plastic coating wrapped around them. How does this make the wires safer to handle?
    - Plastic will melt if the wires overheat.
    - Plastic is a good insulator.
    - Plastic is smooth and not easily frayed.
    - Plastic does not react chemically with air.

**Lithium atom**

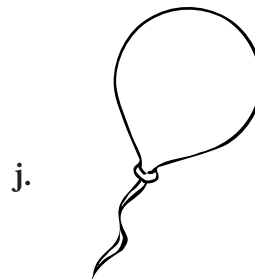
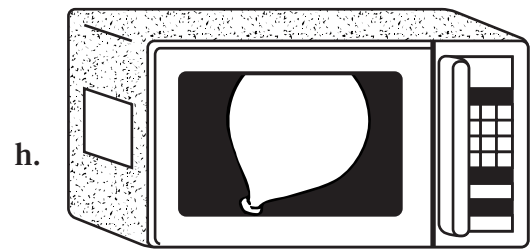
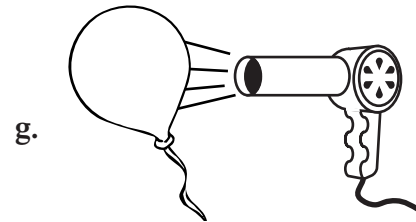
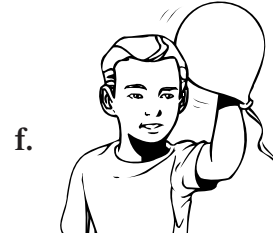
- Why is this lithium atom electrically neutral?
  - The number of protons equals the number of electrons.
  - The number of neutrons equals the number of electrons.
  - The number of protons equals the number of neutrons.
  - The sum of the protons and electrons is greater than the number of neutrons.

**GO ON**



4. What is the electrical current passing through this ammeter?
- 5 amps
  - 7.5 amps
  - 8.5 amps
  - 10 amps
5. Which of these devices provides safety in an electric circuit?
- battery
  - switch
  - circuit breaker
  - light bulb

6. What is the best way to produce static electricity on the surface of the balloon?



**Standardized Test Practice** Chapter 7 *Electricity*
**DIRECTIONS**

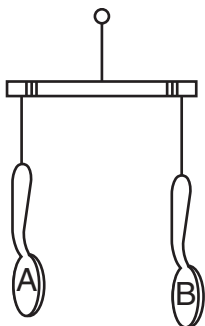
Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

- 1** Most of the electrical energy used by a toaster is converted to

**A** heat energy  
**B** light energy  
**C** mechanical energy  
**D** chemical energy

- 2** Mr. Robinson and his seventh-grade science class are conducting an experiment. The class needs to choose a good insulator. Which of the following could be used as an insulator?

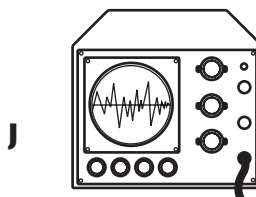
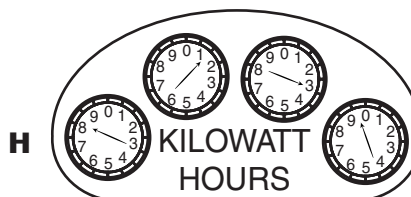
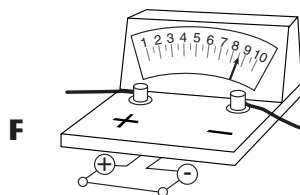
**F** plastic plate  
**G** silver spoon  
**H** copper wire  
**J** gold necklace



- 3** Which of the following might make the spoons repel each other?

**A** Neither A nor B is electrically charged.  
**B** Both A and B are negatively charged.  
**C** A is positively charged, and B is negatively charged.  
**D** A is negatively charged, and B is not electrically charged.

- 4** Which of the following instruments would be used to measure electric energy usage?



- 5** After Peter removes his sweater by pulling it over his head, he notices that his hair is standing straight up. What causes this to occur?
- A** accumulation of protons
  - B** accumulation of neutrons
  - C** shock
  - D** accumulation of electrons

- 6** The amount of power a microwave oven uses is measured in
- F** degrees
  - G** calories
  - H** kilograms
  - J** watts

**Directions:** Read Number 7 below. Then, on the lines that follow, write your answer in complete sentences.

- 7** The Gibson family lives in Arizona, where the days are warm and sunny all year round. On the side of their house that faces south, they have a solar heating system. This system uses the Sun's energy to heat water for family use. What are some of the benefits of having such a system?

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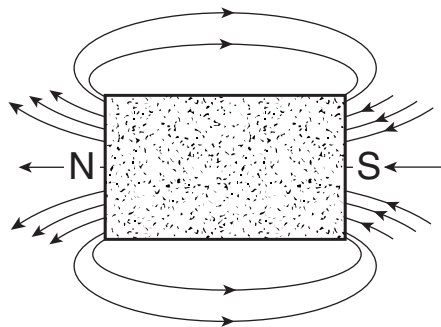
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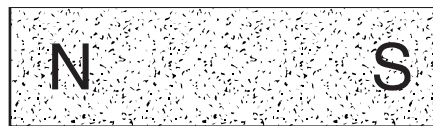


**DIRECTIONS**

Choose the best answer choice for each of the following questions.



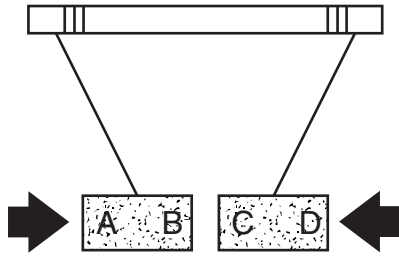
1. The diagram above shows the magnetic field surrounding a bar magnet. The closer together the lines of force, the stronger the magnetic field. According to the diagram, where is the magnetic field strongest?
  - a. around the north pole
  - b. around the south pole
  - c. around both poles
  - d. in the center of the magnet
  
2. Alexandra was preparing to go on a hike in the woods. She gathered the equipment she would need and placed it on the kitchen counter. By chance, she placed her compass near an electrical outlet. Although the compass was not moving, the compass needle turned because \_\_\_\_\_.
  - f. the electric current in the outlet produced a magnetic field
  - g. the compass could only be used outdoors
  - h. the kitchen counter was made of a magnetic substance
  - j. the kitchen had a microwave oven



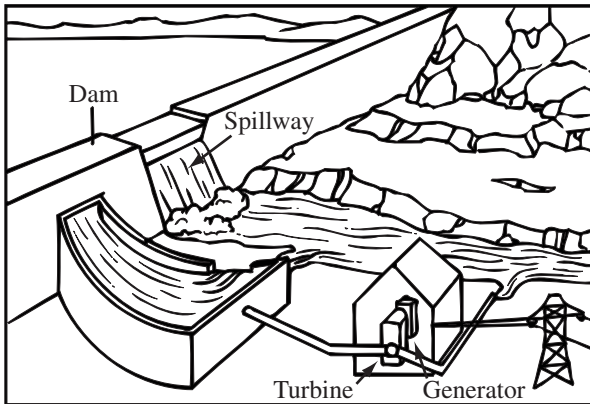
3. Which pair of magnets would result from cutting this magnet in half?



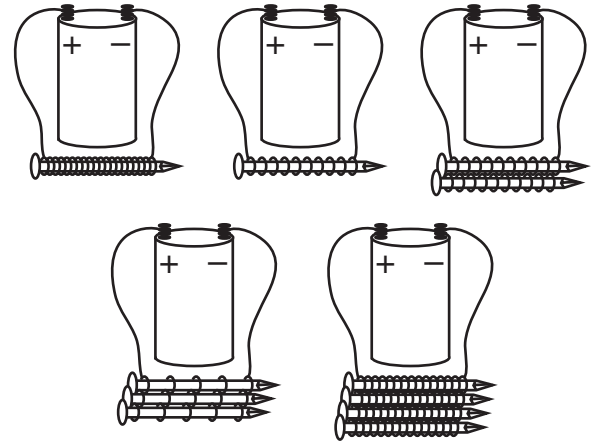




4. According to the diagram, which pair could both be north poles?
- A and B
  - B and C
  - A and C
  - C and D



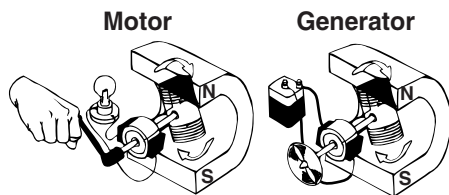
5. This structure produces power for use in the home by converting \_\_\_\_\_.
- chemical energy into mechanical energy
  - electrical energy into mechanical energy
  - chemical energy into electrical energy
  - mechanical energy into electrical energy



6. The picture shows an experiment used to determine the effect of using more nails in the core of an electromagnet. Which of the following would make this a better-designed experiment?
- using a different number of batteries for each electromagnet
  - using the same number of turns of wire for each electromagnet
  - inserting an ammeter in each circuit between the battery and the nails
  - using a different size battery for each electromagnet

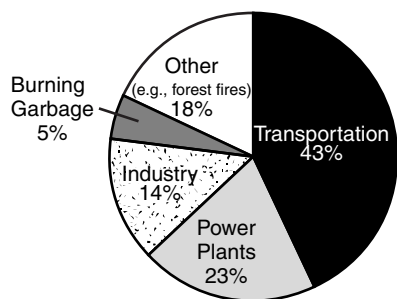
**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.



- 1** The diagram above shows an electric motor and a generator. Which two areas of physical science are closely related to the development of these devices?

- A** sound and light
- B** light and magnetism
- C** electricity and sound
- D** electricity and magnetism

**Causes of Air Pollution**

- 2** Based on the information in the graph, which of these would probably improve the quality of the air we breathe?

- F** burn coal in place of petroleum to produce electricity
- G** develop an electric-powered automobile
- H** allow people to burn their own garbage
- J** require industries to work only at night

- 3** Sandra is trying to identify an unknown substance. She determines by testing that it has a density of  $7.5 \text{ g/cm}^3$  and can be picked up by a magnet. She concludes that the matter is

- A** wood
- B** iron
- C** calcium
- D** plastic

**Homemade Electromagnets**

Number of Batteries	Number of Wire Turns	Number of Nails	Number of Tacks Lifted
1	20	1	3
1	40	1	7
2	20	1	6
2	40	1	13
1	20	2	6
1	40	2	14
2	20	2	15
2	40	2	29

- 4** Hamed wanted to find out how to make an electromagnet stronger. The results of his experiment are listed in the table above. According to these data, which of the following does not make an electromagnet stronger?

- F** increasing the number of batteries that are connected
- G** increasing the number of wire turns around the core
- H** increasing the number of nails inside the core
- J** increasing the number of tacks used

**GO ON**

**5** A galvanometer is an instrument used to detect small amounts of electric current. The current detected is most likely measured in

- A** milliliters
- B** milligrams
- C** milliamperes
- D** milliseconds

**6** Scientists believe that magnetism is caused by the spin of certain atomic particles called

- F** electrons
- G** protons
- H** neutrons
- J** nuclei

**Directions:** Read Numbers 7 and 8 below. Then, on the lines that follow, write your answers in complete sentences.

**7** Design an experiment to gather data about what factors might cause a bar magnet to lose its magnetism.

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**8** Amelia was walking across her bedroom. When she touched her bedroom doorknob, she felt a small shock. Explain what happened to allow Amelia to experience static electricity. Use the word “electrons” in your answer.

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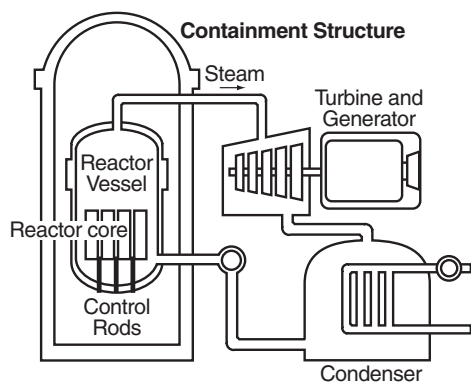
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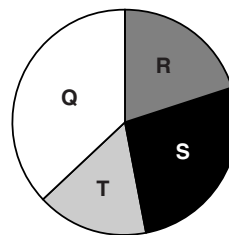


**DIRECTIONS**

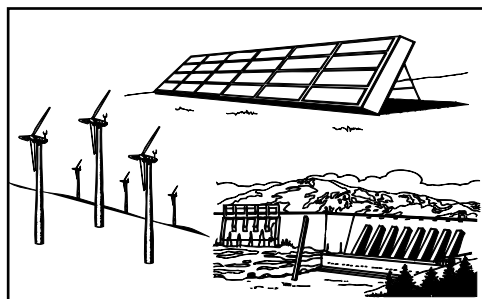
Choose the best answer choice for each of the following questions.



1. The diagram shows a typical nuclear power plant. When a neutron strikes a U-235 nucleus, the nucleus splits into two smaller nuclei and a few neutrons. What structure absorbs most of the neutrons produced so that a controlled chain reaction occurs?
  - a. containment structure
  - b. control rods
  - c. reactor vessel
  - d. turbine and generator

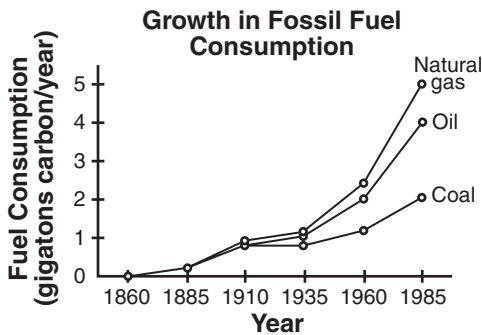
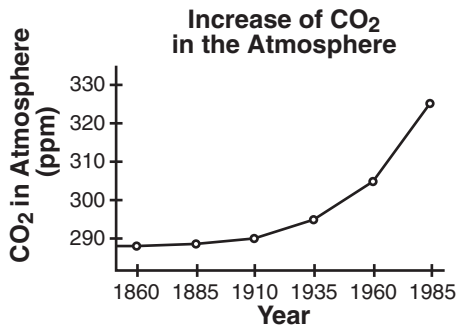


2. Alan researched how energy is used in the United States. He found that 20% is used in homes, 27% is used for transportation, 16% is used for business, and 37% is used by industry. Which area of the graph represents transportation?
  - f. Q
  - g. R
  - h. S
  - j. T



3. What characteristic do these structures have in common?
  - a. use of renewable resources to produce electricity
  - b. use of nonrenewable resources to produce electricity
  - c. major sources of energy used to produce electricity
  - d. significant contribution to air pollution

**GO ON**

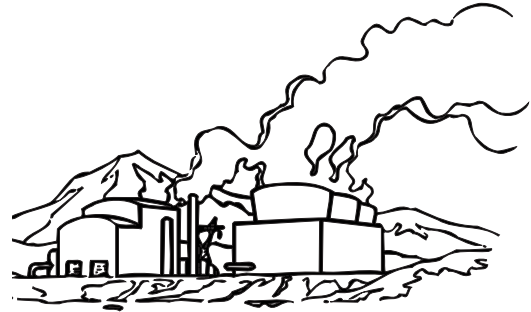


4. The two graphs show the increase in carbon dioxide in the atmosphere and the growth in fossil fuel consumption over a number of years. A reasonable hypothesis based on these data is that if the consumption of fossil fuels increases, then \_\_\_\_\_.
- carbon dioxide in the atmosphere will increase
  - carbon dioxide in the atmosphere will decrease
  - carbon dioxide in the atmosphere will remain constant
  - carbon dioxide in the atmosphere will be converted to the more hazardous carbon monoxide

### Information About Some Bulbs

Bulb Type	100W Incandescent	23W Compact Fluorescent
Life of Bulb	750 hours	10,000 hours
Number of Bulbs Needed	About 6 over 3 years	1 over 6.8 years
Total Cost of Electricity (8 cents/kilowatt-hour)	\$35.04	\$8.06
Your Total Cost Over 3 Years	\$39.54	\$19.06

5. About how much does a consumer save over three years by using a fluorescent bulb in place of an incandescent bulb?
- \$10.50
  - \$19.00
  - \$20.50
  - \$30.50



6. This structure is able to use renewable energy to produce electricity by making steam that spins turbines attached to electrical generators. The renewable energy this structure uses is most likely from \_\_\_\_\_.
- the Sun
  - burning biomass
  - burning fossil fuels
  - hot molten rock beneath Earth's crust

**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

**1** Which of these energy sources produces the least air pollution?

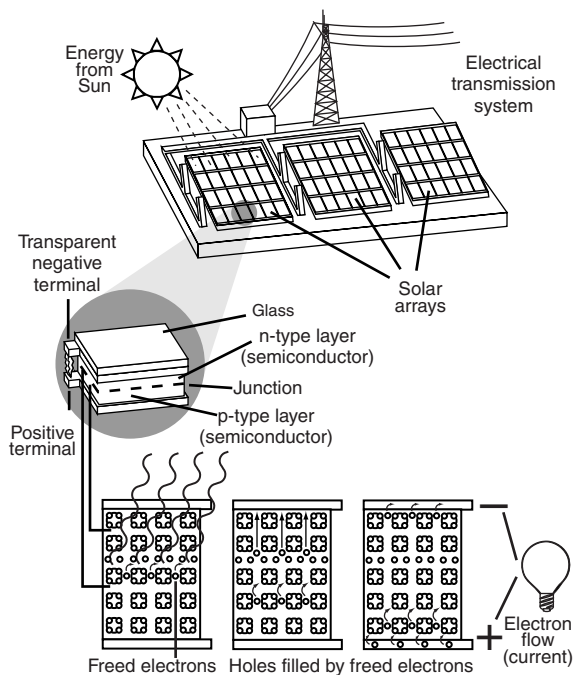
- A** coal
- B** natural gas
- C** nuclear
- D** petroleum

**2** Burning renewable organic matter, such as sugarcane fibers, can produce electricity. Such renewable organic matter is called

- F** geothermal energy
- G** biomass fuel
- H** hydroelectric energy
- J** fossil fuel

**3** Which of the following is not a problem usually associated with nuclear energy?

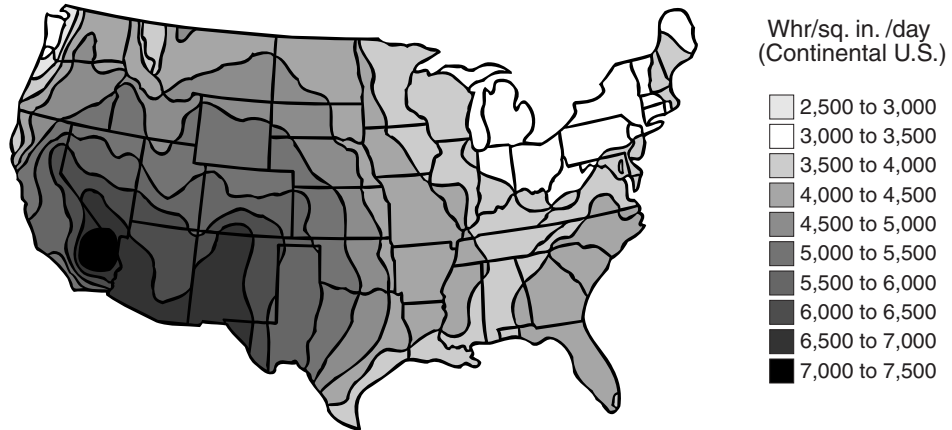
- A** disposal of radioactive waste
- B** thermal pollution of rivers and streams
- C** environmental damage from mining and extraction of uranium
- D** emission of carbon dioxide into the atmosphere

**Inside a Photovoltaic Cell**

**4** The diagram shows a photovoltaic cell, a device used to convert solar energy into electricity. Some photovoltaic cells are used to

- F** power electronic calculators
- G** provide hospitals with energy
- H** power nuclear reactors
- J** alarm indoor safes

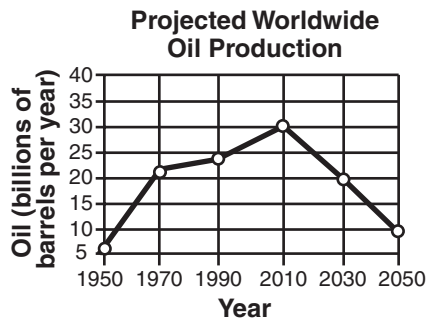
### Potential Power Generated by Solar Energy



**5** One disadvantage of using solar energy to generate electricity is that the number of hours of available sunlight isn't the same all over Earth. Which region of the United States has the greatest potential for producing electricity from solar energy?

- A** northwest
- B** midwest
- C** northeast
- D** southwest

**Directions:** Read Number 6 below. Then, on the lines that follow, write your answer in complete sentences.



**6** Some estimates suggest that petroleum resources might be nearly depleted by the middle of this century. Describe three alternate energy sources that could be developed to generate electricity in the next 50 years.

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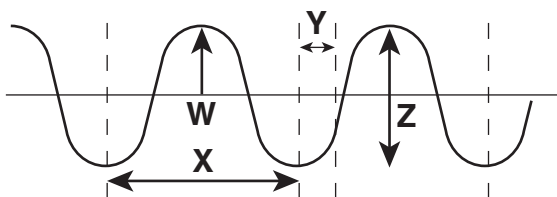


**DIRECTIONS**

Choose the best answer choice for each of the following questions.

Jet Engine Output (% of Full Power)	Noise Level at 10 Meters (Decibels)
10	13
20	26
30	39
40	52
50	65
60	?

- According to safety engineers working on hearing protection, a jet engine at 10% of full power can generate 13 decibels of sound. Based on this data, how much sound will the engine make at 60% power?
  - 65 decibels
  - 80 decibels
  - 78 decibels
  - 102 decibels

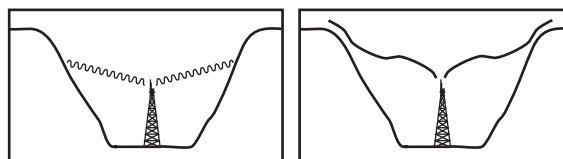


- Which of the measurements would be the most helpful in determining the wavelength?
  - W
  - X
  - Y
  - Z

**Tuning Fork**

Type	Does it resonate in response to a 440 Hz tuning fork?	Does it resonate in response to a 450 Hz tuning fork?	Does it resonate in response to a 460 Hz tuning fork?
A			
B			
C			
D			

- The table shows a setup for recording the results of an experiment. Which of the following is probably the hypothesis for this experiment?
  - Tuning forks can create waves with troughs and crests.
  - Tuning forks' sound waves can diffract around an object.
  - Tuning forks can generate standing waves.
  - Tuning forks have resonance frequencies.

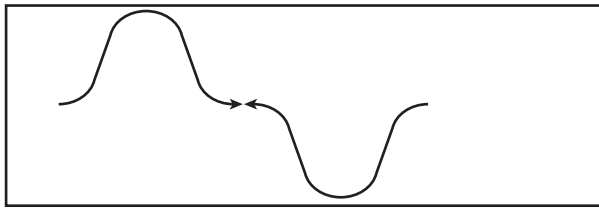


**Short Wavelengths**      **Long Wavelengths**

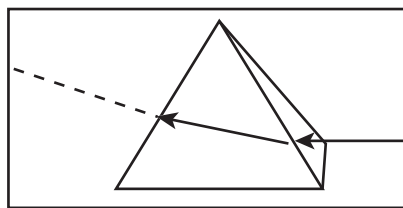
- According to the diagrams, long wavelengths \_\_\_\_\_.
  - travel more slowly than short wavelengths
  - have a greater frequency than short wavelengths
  - diffract around objects more easily than do short wavelengths
  - are able to generate far more power than are short wavelengths

**GO ON** 



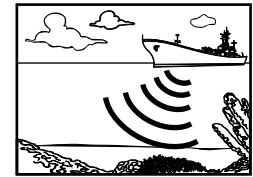


5. The diagram above shows two waves that will collide. Which of the following shows what the resulting interference pattern will be?



6. The glass prism is able to bend light because \_\_\_\_\_.
- light is refracted as it enters a different medium
  - the prism offers destructive interference
  - energy is diffracted when it encounters an obstacle
  - the glass and the light's wavelength create resonance

7. Which of the following would have the LEAST effect on an experiment exploring an object's resonance frequency?
- the lighting conditions
  - the air density
  - the sound wave's amplitude
  - the sound wave's frequency



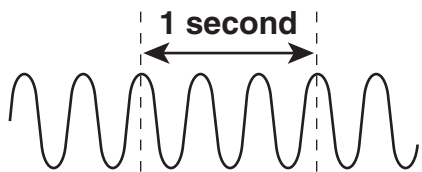
8. Which of the following is present in both drawings?
- compression waves
  - diffraction
  - destructive interference
  - refraction
9. Which of the following is a transverse wave?
- waves generated by a violin
  - vibrations that are felt through a rock
  - sounds made underwater
  - an ocean wave approaching the shore

**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

- 1** Sound is a compression wave with regions of greater and lesser density. The less-dense region of a sound wave is a

- A** crest
- B** rarefaction
- C** diffraction
- D** compression



- 2** In 1 second, four crests of a wave pass a certain point. What is the wave's frequency?

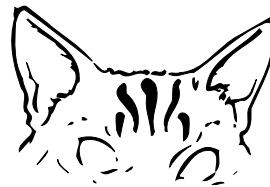
- F** 2 Hz
- G** 3 Hz
- H** 4 Hz
- J** 5 Hz

- 3** A collision between which of the following does not result in constructive interference?

- A** two rarefactions
- B** a crest and a wave peak
- C** two compressions
- D** a crest and a trough

- 4** Which statement best explains frequency?

- F** Frequency is the number of wavelengths that pass a point per second.
- G** Frequency is the number of crests that pass a point in total.
- H** Frequency is the number of wavelengths that pass a point in total.
- J** Frequency is the amplitude per second.



- 5** For what purpose do you think this animal uses its specialized ears?

- A** capturing transverse waves from the air
- B** creating resonance with nearby animals
- C** creating standing waves with distant objects
- D** capturing compression waves from the air

- 6** The main reason that a standing wave occurs is because
- F** waves of equal wavelength and amplitude that travel in the same direction combine and form a new wave
  - G** waves of equal wavelength and amplitude that travel in different directions combine and form a new wave
  - H** waves of equal wavelength and amplitude that travel in the same direction continuously interfere with each other
  - J** waves of equal wavelength and amplitude that travel in different directions continuously interfere with each other

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**Directions:** Read Numbers 7–8 below. Then, on the lines that follow, write your answers in complete sentences.

- 7** A certain sound wave has a wavelength of 2 m and a frequency of 170 hertz. Use the wave velocity equation to calculate the velocity of this wave.

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- 8** In a forest, many animals communicate with high-frequency, short-wavelength sounds. What is the difference in the diffraction characteristics of short-wavelength sounds versus long-wavelength sounds?

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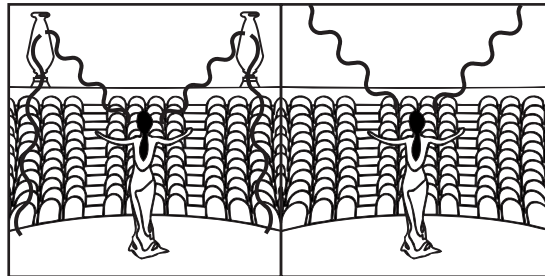
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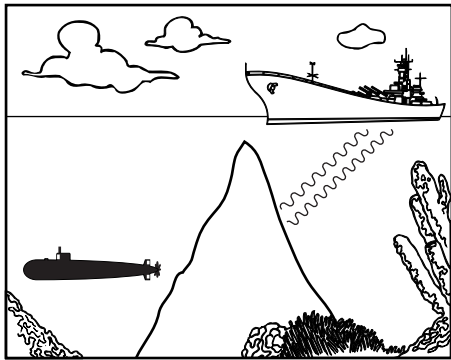
**DIRECTIONS**

Choose the best answer choice for each of the following questions.

1. Which statement best describes what happens when more waves pass a certain point per second?
  - a. They accelerate.
  - b. They transport less energy.
  - c. They make a lower pitch.
  - d. They increase in frequency
  
2. Which of the following is probably the loudest?
  - f. a running hair dryer
  - g. a sound of 3 decibels
  - h. an ultrasonic whistle
  - j. the infrasonic rumble of an earthquake
  
3. Doctors use ultrasound to crumble kidney stones because \_\_\_\_\_.
  - a. hard objects absorb X rays
  - b. hard objects absorb ultrasound waves
  - c. ultrasonic frequencies are too low to be heard
  - d. ultrasounds can detect stones in a patient's lungs



4. Amphitheaters, outdoor auditoriums in ancient Rome, were fine-tuned by experts in acoustics who placed giant vases throughout the amphitheater. Which process occurs as a result of the placement of vases?
  - f. echolocation
  - g. reverberation
  - h. Doppler shift
  - j. imaging
  
5. A student is learning how to play a woodwind instrument. Which of the following would LEAST affect the frequency of the sound made by the woodwind?
  - a. the length of the air column
  - b. the vibration of the mouthpiece
  - c. the air's compressions and rarefactions
  - d. the amplitude of the sound waves



6. To avoid detection by an enemy ship, the submarine was placed next to an undersea mountain. This hides the submarine because \_\_\_\_\_.
- the ship's hydrophones are confused by the undersea mountain
  - there is no difference between a mountain and a submarine to the sonar
  - the submarine is the same color as the mountain
  - the ship's sonar cannot send sound through the undersea mountain
7. The Hubble Space Telescope is a remotely controlled observatory that orbits Earth. Hubble can detect the light waves that distant stars emit. If a redshift is detected in a star's light emissions, then that star is \_\_\_\_\_.
- approaching Earth
  - too far away to be seen
  - moving away from Hubble
  - emitting light with poor acoustics

8. A student uses an electronic tuner to measure the frequency of a stationary car's horn. Then the student measures the car's horn frequency while the car drives away. The student is most likely trying to investigate \_\_\_\_\_.
- the Doppler effect
  - vibrations in the inner ear
  - noise pollution
  - the location of the nearest resonator

Boulder Temperature (°C)	Speed of Sound (m/s)
-5	562
0	564
10	566
15	568
20	?

9. A student is studying how sound travels through a solid medium by timing the movement of sound through a boulder when the boulder is at different temperatures. Using the information above, how fast will sound move through the boulder when it reaches 20°C?
- 569 m/s
  - 570 m/s
  - 571 m/s
  - 572 m/s



**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

**1** Which of the following is not a bone?

- A** anvil
- B** stirrup
- C** eardrum
- D** hammer

**2** The main problem that occurs when humans are exposed to too much noise pollution is that the noise

- F** damages the inner ear
- G** interferes with conversations
- H** vibrates the internal organs
- J** resonates inside the body

**3** Which statement best explains reverberation?

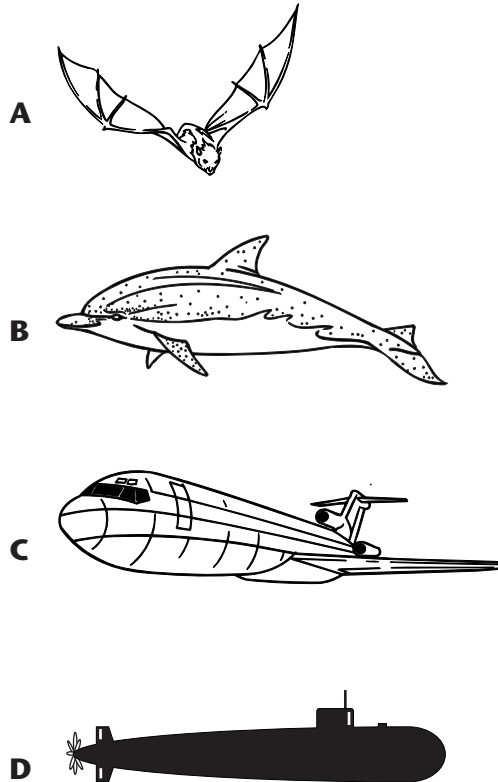
- A** A reverberation is an echo.
- B** A reverberation occurs when a room with good acoustics does not reflect sound.
- C** A reverberation occurs when echoes are used to locate the source of a sound.
- D** A reverberation occurs when there are many reflections of a sound.

**Vibrations → Air → Eardrum → Middle Ear**

**4** Which of these statements is true?

- F** The middle ear makes the air vibrate.
- G** Vibrations in the air reach the eardrum.
- H** The eardrum makes the air vibrate.
- J** Vibrations in the air make energy.

**5** Which of the following is least likely to use echolocation?



- 6** Police officers use a special device to determine the speed of cars traveling on the highway. This device works by sending a wave toward the car, detecting its reflection, and measuring subtle compressions and rarefactions in the reflected wave. This device relies on
- F** acoustics
  - G** the Doppler effect
  - H** beats
  - J** a fundamental frequency

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**Directions:** Read Numbers 7–8 below. Then, on the lines that follow, write your answers in complete sentences.

- 7** Explain how a vibration in the air on the other side of a room results in your perception of sound and loudness.

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- 8** Sound waves are now used in certain medical procedures. Explain how the use of sound waves has changed the way in which one of these procedures is performed.

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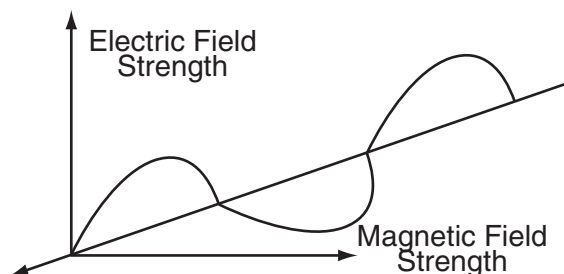
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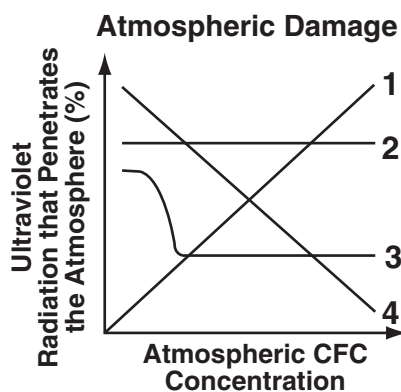


**DIRECTIONS**

Choose the best answer choice for each of the following questions.

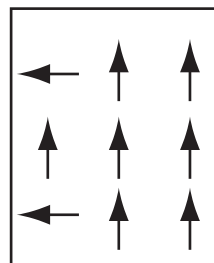


1. An electromagnetic wave is able to produce both an electric field and a magnetic field because —
  - a. photons absorb magnetic energy
  - b. they are always made at the same time
  - c. the fields continually recreate each other
  - d. they behave like matter instead of waves



2. Scientific evidence suggests that air pollution is damaging our atmosphere. Which line on the graph supports the idea that pollution is damaging the ozone layer?
  - f. Line 1
  - g. Line 2
  - h. Line 3
  - j. Line 4

3. How do electromagnetic waves communicate information?
  - a. Use of a transceiver
  - b. By refraction
  - c. Gamma rays
  - d. Amplitude modulations



4. A Magnetic Resonance Imager (MRI) works by detecting the tiny magnetic fields of atoms that make up our bodies. The device first aligns all the magnetic fields in the body and then tries to flip them. The time and energy required to flip a magnetic field reveals details about the matter inside the patient. If the sketch above represents an MRI analysis of human tissue, what can you conclude about the top left and bottom left arrows?
  - f. They are the same type of tissue.
  - g. They have different electromagnetic properties.
  - h. They are unaffected by the MRI.
  - j. They are not the same type of tissue.



5. Joseph studied whether different materials can block certain electromagnetic waves by testing television reception in different parts of a house. At each part of the house, Joseph used a different antenna. The experiment could have been improved by \_\_\_\_\_.
- testing reception of a different channel during each trial
  - using the same antenna during each trial
  - measuring the antenna length in centimeters
  - measuring the distance to the television station
6. Which of the following could be used to send and receive electromagnetic waves at the same time?
- transceiver
  - cathode-ray tube
  - pager
  - Global Positioning System
7. Under which of the following headings in a table of contents would information about cathode-ray tubes most likely be found?
- How Do Sounds Travel to My Telephone?
  - How Do Television Shows Travel to My Television?
  - How Do Images Appear on my Television Screen?
  - How Do Sounds Travel to My Radio?
8. Which of the following is a major characteristic of a carrier wave?
- frequency of a wave used to communicate to cell phones
  - frequency of a wave used to communicate to televisions
  - frequency of a wave used to communicate to satellites
  - frequency of a wave assigned to a radio station
9. Rahim heated some leftovers in a microwave oven. He noticed that although the food got hot, the inside of the microwave oven did not. This happens because \_\_\_\_\_.
- the walls of the microwave oven are good heat insulators
  - there is no air in a microwave oven
  - the fan in the microwave oven keeps it cool
  - microwaves heat by interacting with water molecules

**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

**1** Which of the following pieces of equipment would be best for scanning a person's internal organs?

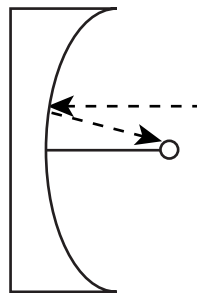
- A** large dish antenna
- B** Magnetic Resonance Imager
- C** magnet
- D** Global Positioning System

**2** Photons act like both waves and particles. Albert Einstein observed that light, an electromagnetic wave made of photons, can be affected by gravity. Photons are also like waves in that they

- F** carry energy
- G** move through space
- H** have a measurable amount of mass
- J** are able to travel at incredibly high speeds

**3** You can vibrate the electric fields of water molecules using

- A** radio waves
- B** infrared waves
- C** ultraviolet waves
- D** microwaves



**4** What is the purpose of the large parabolic surface?

- F** transmitting a carrier wave
- G** focusing the signal
- H** blocking ultraviolet waves
- J** sending a telephone call

**5** Which statement best defines radiant energy?

- A** Radiant energy is the energy that must travel through certain types of media.
- B** Radiant energy is the energy carried by an electromagnetic wave.
- C** Radiant energy is the energy carried only by magnetic waves.
- D** Radiant energy travels at short wavelengths.

**6** Which of the following uses radio waves?

- F** radar
- G** radiation therapy
- H** X-ray machine
- J** CD-ROM

**7** Which of the choices below relies on frequency modulations to transmit information?

- A** AM radio
- B** X-ray machine
- C** cathode-ray tube
- D** FM radio

**Directions:** Read Numbers 8–9 below. Then, on the lines that follow, write your answers in complete sentences.

**8** Satellite telephones permit communication with remote locations. These devices rely on ground stations and satellites. Explain how a satellite telephone can reach a telephone in your home. Draw a picture as part of your explanation.

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**9** The ozone layer is a small percentage of Earth's atmosphere. Discuss why many scientists and health care professionals are concerned about the ozone layer.

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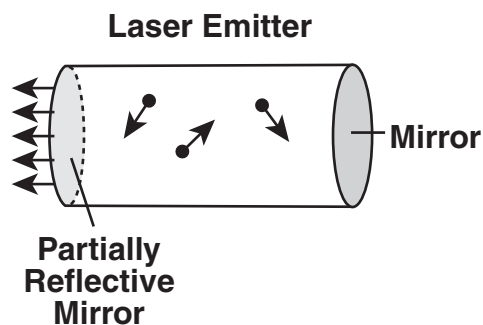


**DIRECTIONS**

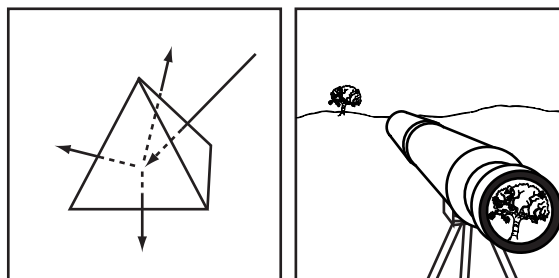
Choose the best answer choice for each of the following questions.

Optic fiber	Length of optic fiber (cm)	Amount of light entering fiber	Amount of light emitted at end of fiber	Weight of optic fiber (g)	Color of optic fiber
1	20				
2	20				

- The table above was set up to record data generated by an experiment. Which of these is the most likely hypothesis supported by this experiment?
  - Optical fibers filter different wavelengths of light.
  - Optical fibers have total internal reflection.
  - An optic fiber's weight affects its light transmission.
  - An optic fiber's color affects its translucence.

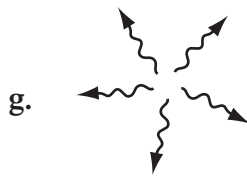
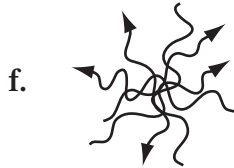


- This device is able to emit a coherent beam of light because \_\_\_\_\_.
  - helium and neon react chemically and release heat
  - it captures and stores sunlight
  - the coherent light transfers energy to the atoms in the chamber
  - the mirror on the left lets some light through



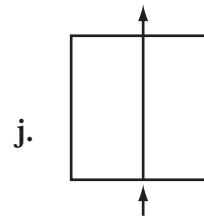
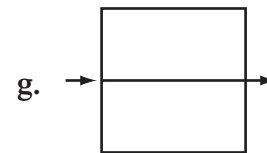
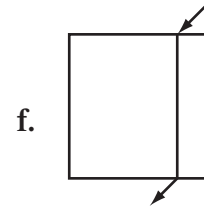
- Which of the following processes is occurring in both pictures?
  - polarization of light
  - total internal reflection
  - refraction of light
  - light becoming coherent

4. Light rays have direction and can be depicted with arrows. Which of the following shows what coherent light looks like?



5. A group of students is trying to make different colors with different pigments. Which of the following would have the greatest impact on the color of the final product?
- the volume of the pigments mixed together
  - the size of the container used to mix the pigments
  - the proportion of the different pigments used
  - the total amount of pigments used

6. Which of the following would be the best way to determine a glass block's index of refraction?



7. Sometimes people in the desert see what appears to be water. This happens because \_\_\_\_\_.
- heated sand refracts light
  - the Sun transmits blue-light wavelengths
  - light refracts through air of different densities
  - their eyes' cones and rods are heat-sensitive

**Standardized Test Practice** Chapter 13 *Light***DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

- 1** Which statement best defines coherent light?
- A** Coherent light is comprised of one wavelength of light that travels in one direction.
  - B** Coherent light is comprised of one wavelength of light that travels in different directions.
  - C** Coherent light is comprised of different wavelengths of light that travel in one direction.
  - D** Coherent light is comprised of very diluted light.
- 2** Which of the choices below is the most transparent?
- F** glass windows
  - G** curtains
  - H** desk
  - J** glass of milk
- 3** Which of the following statements is true?
- A** Pictures make holograms.
  - B** Lasers make holograms.
  - C** Lasers make pictures.
  - D** Holograms make lasers.
- 4** Tungsten-halogen bulbs last longer and burn brighter than incandescent bulbs because of the
- F** chlorine or fluorine
  - G** vacuum
  - H** neon gas
  - J** sodium vapor
- 5** A prism creates a rainbow by the process of
- A** halography
  - B** refraction
  - C** polarization
  - D** reflection
- 6** A student is studying light. Using special filters, she can make all of the light's transverse waves vibrate vertically. She determines that their light is
- F** a mirage
  - G** fluorescent
  - H** incoherent
  - J** polarized

**7** Which of the following materials would you expect to be translucent?

- A** curtains
- B** wall
- C** window
- D** waxed paper

**8** Which of the following would absorb the most sunlight?

- F** a white t-shirt
- G** a yellow t-shirt
- H** a black t-shirt
- J** an orange t-shirt

**Directions:** Read Numbers 9–10 below. Then, on the lines that follow, write your answers in complete sentences.

**9** Different electrical devices are used to produce light. Discuss the different types of electric lights used today.

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**10** The human eye detects light using specialized cells that look like rods and cones. What is the difference between the function of a rod and the function of a cone?

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**DIRECTIONS**

Choose the best answer choice for each of the following questions.

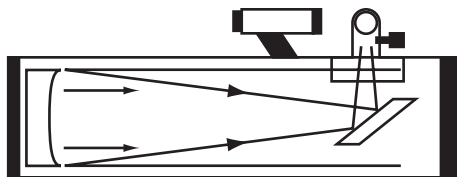
TELESCOPE   MICROSCOPE   CAMERA
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- Which of these belongs with the group above?
  - Optical Instruments
  - Nearsightedness
  - Farsightedness
  - Light Rays

**Mirrors**

Object's distance to focal point (focal lengths)	Image of object	Size of image compared to object
4	Inverted and real	Enlarged
1.5	Inverted and real	Enlarged
2	Inverted and real	Enlarged

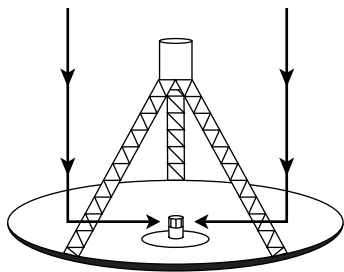
- Three similar mirrors are studied and their properties are recorded in the table above. According to this information, all three mirrors are \_\_\_\_\_.
  - plane mirrors
  - concave mirrors
  - convex mirrors
  - refracting mirrors



- The picture illustrates the instrument a student used for an astronomy experiment. Which of the following was the student using?
  - reflecting telescope
  - virtual telescope
  - refracting telescope
  - camera
- A refracting microscope enables us to see individual cells because it magnifies the light coming from a specimen using \_\_\_\_\_.
  - two convex lenses
  - two concave lenses
  - a convex lens and a plane mirror
  - a concave lens and a plane mirror

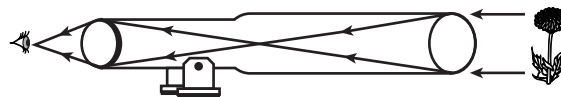


5. After studying lenses, a student wanted to determine her neighbor's vision. Which of the following might be true if the neighbor is nearsighted?
- The lenses of the neighbor's eyes are not flexible enough.
  - The neighbor has trouble focusing on something less than 10 centimeters away.
  - The neighbor wears convex eyeglasses.
  - The neighbor wears concave eyeglasses.



6. A parabolic satellite dish helps capture and concentrate electromagnetic waves in a manner similar to the way mirrors work. This satellite dish works much like \_\_\_\_\_.
- a plane mirror and a lens
  - a refracting telescope
  - the objective and eyepiece in a microscope
  - a concave or a convex mirror

7. Which of the following shows the correct path of a light beam inside of a reflecting telescope?
- Concave mirror → Eyepiece → Plane mirror
  - Plane mirror → Concave mirror → Eyepiece
  - Concave mirror → Plane mirror → Eyepiece
  - Eyepiece → Concave mirror → Plane mirror
8. Stacey sits on the passenger side when her mother drives her to school. She noticed in the side view mirror the words "Caution: Objects may be closer than they appear." The side view mirror is most likely a \_\_\_\_\_.
- concave mirror
  - convex mirror
  - plane mirror
  - plastic mirror



9. Which of the following is the best way to focus the telescope on the image of the object?
- Change the distance between the two lenses
  - Turn the telescope upside-down
  - Use an eyepiece with greater magnification
  - Look at a closer, larger object

**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

- 1** Which of the following can be used as a corrective aid by people who are farsighted?
- A** convex lenses
  - B** plane mirrors
  - C** concave lenses
  - D** wide-angle lenses
- 2** Which of the following best explains what a virtual image is?
- F** an image that you perceive to be behind a mirror
  - H** an image that you perceive to be in front of a mirror
  - G** any image that you can perceive
  - J** an image that is real and reflected
- 3** The main purpose of using a wide-angle lens is that it
- A** is very sensitive and can work in poor lighting
  - B** has a short focal length and produces a small image of an object and its surroundings
  - C** has a long focal length and produces a large image of an object without its surroundings
  - D** concentrates light rays on a focal point
- 4** A refracting telescope uses two lenses. The eyepiece lens usually
- F** forms an image inside the telescope
  - G** redirects the light from a distinct object onto a plane mirror
  - H** reflects the light from a distinct object to another lens
  - J** enlarges the image formed inside the telescope
- 5** Which of the following statements is true?
- A** A farsighted eye's lens cannot be made flat enough.
  - B** a farsighted eye's lens is too flexible.
  - C** A person who cannot focus on a very close object is farsighted.
  - D** A person who cannot focus on a very close object is nearsighted.
- 6** The length of the optical axis from the focal point to the lens is called the
- F** real image
  - G** focal length
  - H** optical length
  - J** telephoto

- 7** Cameras have shutters. The shutters usually help people take pictures with a camera by
- A** allowing light to enter the camera for a specific length of time
  - B** forming a real, enlarged image of the object to be in the picture
  - C** magnifying and inverting the real image of the object to be in the picture
  - D** focusing the light on the lens after it enters the camera

- 8** Scientists built a telescope called the Hubble Space Telescope and placed it into space. By being placed in space, the Hubble Space Telescope can
- F** use fewer lenses to magnify images
  - G** create virtual images of space
  - H** overcome the blurriness of a view of space from Earth
  - J** take wide-angle photographs that include all of the planets in the solar system

**Directions:** Read Numbers 9–10 below. Then, on the lines that follow, write your answers in complete sentences.

- 9** Telescopes can be used to see a distant mountain or a distant galaxy. What is the difference between a reflecting telescope and a refracting telescope?

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- 10** Cameras record images for recreational and professional purposes. What are two types of lenses available for cameras, and what kinds of images do they generate?

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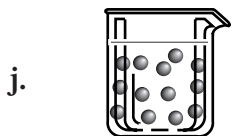
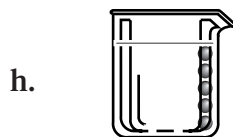
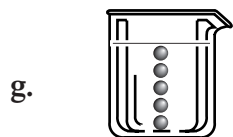
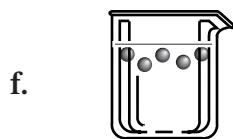
**DIRECTIONS**

Choose the best answer choice for each of the following questions.

Substance	Flame Color
Barium	Yellow-green
Lithium	Crimson
Potassium	Violet
Strontium	Red
Copper	Blue-green

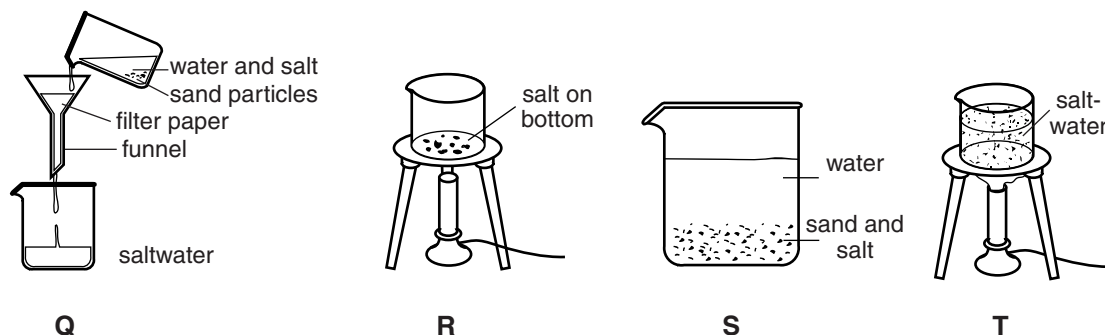
1. According to the chart, a substance that burns with a blue-green flame probably contains \_\_\_\_\_.
- barium
  - lithium
  - potassium
  - copper

2. José's science teacher told him that every part of a salt and water solution is identical. José wanted to collect samples to verify this statement. Which picture shows the sample that verifies this statement?

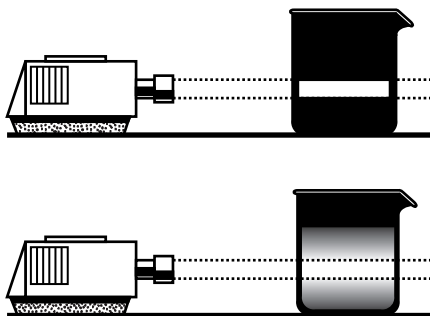


3. Mixtures can be either heterogenous or homogenous. Which of the following is characteristic of a homogenous mixture?
- a mixture in which two or more substances are still distinguished
  - a mixture in which large particles are suspended
  - a mixture in which large particles are not suspended and eventually settle
  - a mixture in which two or more substances are evenly distributed

**GO ON** 



4. These pictures show the different steps in an experiment designed to separate a mixture of salt and sand. Which of these shows the steps in order, from first to last?
- Q, S, R, T
  - R, T, Q, S
  - S, Q, T, R
  - T, R, S, Q



5. Which of these questions would most likely be answered by this experimental setup?
- How do the particles in a suspension and a solution compare in their ability to scatter light?
  - How does light energy affect the rate at which particles dissolve in a suspension and in a solution?
  - Does light change the evaporation rate of a suspension or a solution?
  - How does light energy affect the temperature of a suspension and a solution?



Crushing to powder



Water boiling



Sugar dissolving



Ice melting

6. What do these processes have in common?
- They are all examples of chemical changes.
  - They are all examples of physical changes.
  - They are all examples of reactions that require the addition of heat energy.
  - They are all examples of unsafe laboratory techniques.



**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

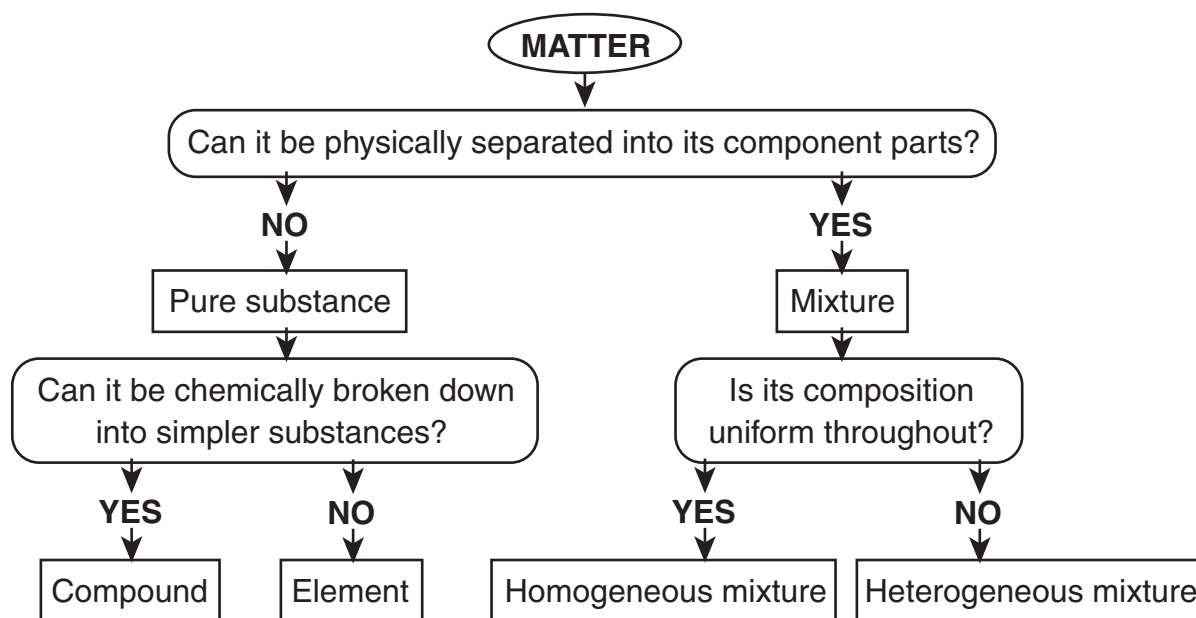
**1** A beam of light from a flashlight is passed through four beakers containing four different substances. Which of these substances would scatter light the least?

- A** saltwater
- B** milk
- C** muddy water
- D** paint

**2** Processes such as dissolving, melting, freezing, and evaporating can affect the appearance of a substance, but the identity of the substance remains the same. These processes are called

- F** chemical changes
- G** chemical properties
- H** physical changes
- J** physical properties

**Directions:** Use the information in the diagram to answer Number 3 below.



**3** According to the diagram, which of these statements is true?

- A** Compounds cannot be broken down into simpler substances.
- B** Elements can be broken down into simpler substances.
- C** Heterogeneous mixtures have a uniform composition throughout.
- D** Homogeneous mixtures have a uniform composition throughout.

**4** Most metallic elements, such as copper and iron, have high melting points. This is a useful property because

- F** it keeps cars made of metal from becoming hot on summer days
- G** it enables people to use pots and pans made of metal to cook food
- H** it prevents machine parts made of metal from rusting
- J** it makes metals easier to melt so they can be poured into molds to make precision tools

**5** Which of the following does not make a solid dissolve faster in a liquid?

- A** stirring the mixture
- B** heating the mixture
- C** using a smaller volume of liquid
- D** breaking the solid into smaller pieces

**6** Felipe took a sample of water from a creek in a glass beaker and placed the glass beaker on his desk. An hour later, he noticed that dirt had settled on the bottom of the beaker, leaving the rest of the water clear. What was the most likely cause of this?

- F** Dirt does not dissolve easily in water taken from a creek.
- G** Felipe should have taken a larger sample of creek water.
- H** Felipe did not leave the creek water on his desk long enough to allow the dirt to dissolve.
- J** Felipe's sample of creek water was a suspension that settled when allowed to stand.

**Directions:** Read Number 7 below. Then, on your answer sheet, write your answer in complete sentences.

**7** The law of conservation of mass states that the mass of all the substances present before a chemical change equals the mass of all the substances remaining after the change. Design an experiment to verify this law.

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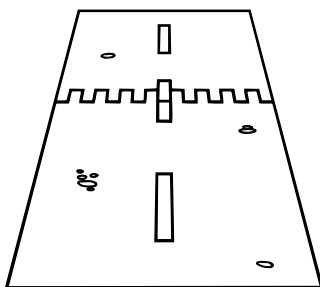
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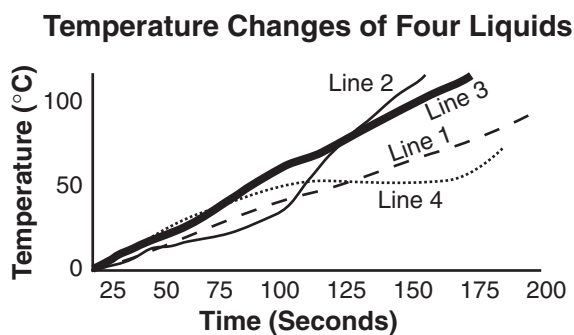


**DIRECTIONS**

Choose the best answer choice for each of the following questions.



1. What is the purpose of putting separations in the roadway of a bridge as shown in the picture above?
  - a. to allow for the expansion of the concrete roadway on hot days
  - b. to make drivers slow down as they pass over the bump
  - c. to make it easier to repair damaged sections of the concrete roadway
  - d. to make the bridge stronger by reinforcing it with steel



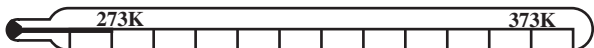
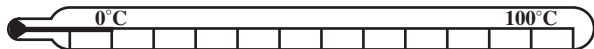
2. The graph represents the temperature changes of four different liquids as they were heated. Which line represents the temperature of a liquid that changed to a gas?
  - f. 1
  - g. 2
  - h. 3
  - j. 4

Pressure (kg/cm <sup>2</sup> )	Volume (mL)
10	600
20	300
30	150
40	?

3. Boyle's Law states that as the pressure exerted on a gas increases, the volume of the gas decreases proportionally. These data were collected after the pressure on 600 milliliters of gas in a sealed container was increased steadily. If everything remains the same, what will be the volume of the gas at a pressure of 40 kilograms per square centimeter?
  - a. 50 mL
  - b. 75 mL
  - c. 150 mL
  - d. 200 mL

**GO ON**

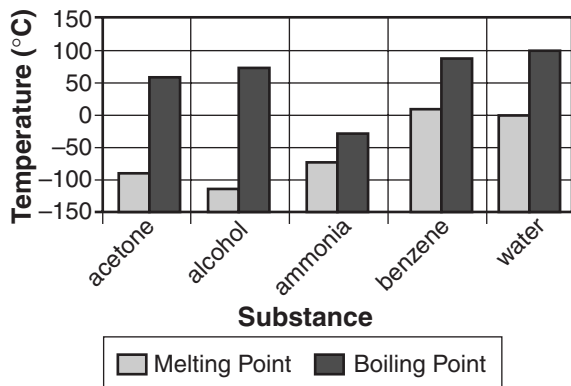




4. The kelvin temperature scale is often used in calculations involving gases. According to the diagram, what is the temperature on the kelvin scale at which water freezes?

- f. 0 K
- g. 273 K
- h. 100 K
- j. 373 K

**Melting and Boiling Points**

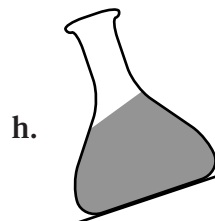
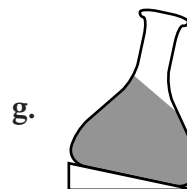
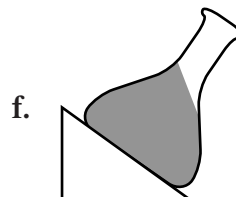


5. According to the graph, all of these substances are liquids at room temperature (20°C) EXCEPT \_\_\_\_\_.

- a. acetone
- b. alcohol
- c. ammonia
- d. benzene



6. The picture above shows an Erlenmeyer flask filled with a liquid. Which of these shows what the liquid will look like when the flask is tilted?

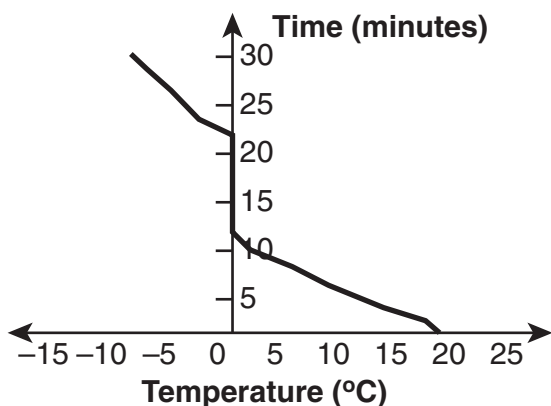


**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

**1** Which of the following is not a property of liquids?

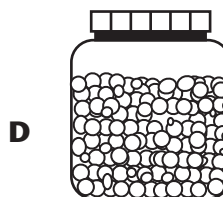
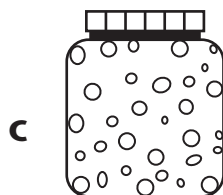
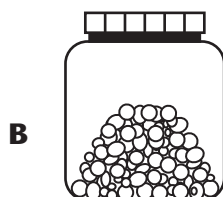
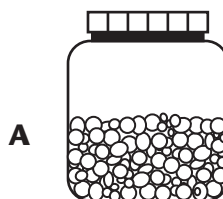
- A** They have a definite shape.
- B** They have a definite volume.
- C** They take the shape of their container.
- D** They have the ability to flow.



**2** Daphne placed a glass of water with a thermometer in it inside a freezer. She took temperature readings every 2 minutes for 30 minutes. The data she recorded are shown in the graph above. What is the most likely cause of the temperature remaining constant during the time interval between the 12- and 22-minute marks?

- F** The ice was melting during that time.
- G** The water was freezing during that time.
- H** The water's kinetic energy was increasing.
- J** The water's kinetic energy was decreasing.

**3** The diagrams show sealed containers, each of which contains a different substance. Which of these diagrams represents the molecules of a gas?



- 4** Wires running between telephone poles are stretched tight in the winter but sag in the summer because
- F** more birds land on the wires in the summer
  - G** the wires expand in the summer heat
  - H** people use more electricity in the summer
  - J** the wires partially melt in the summer heat

- 5** Some liquids, such as motor oil, have a high viscosity. This is a useful property because
- A** it makes the oil easier to pour
  - B** it enables oil companies to retrieve crude oil from underground rock layers
  - C** it prevents the oil from spilling out of large tankers into waterways and onto land, thus preventing environmental damage
  - D** it enables the oil to coat the moving parts of the motor, preventing them from rubbing against each other

**Directions:** Read Number 6 below. Then, on your answer sheet, write your answer in complete sentences.

- 6** Although it was cold outside, Sally was playing basketball in the park with her friends. When her mother came to pick her up, she tossed the basketball inside the trunk of the car. Later that night, she remembered and went to get the ball out of the trunk. To her surprise, the ball had shrunk to almost one-half its original size. Explain why this happened.

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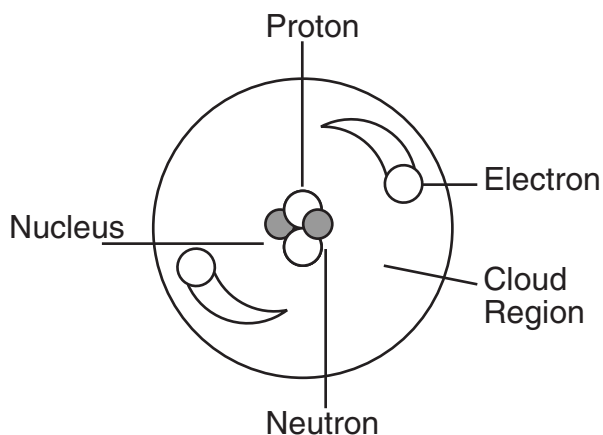
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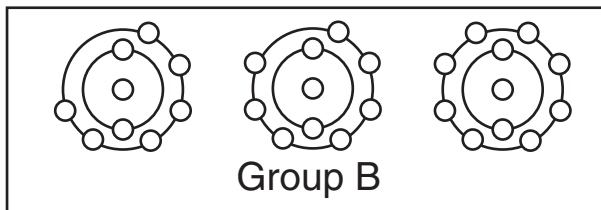
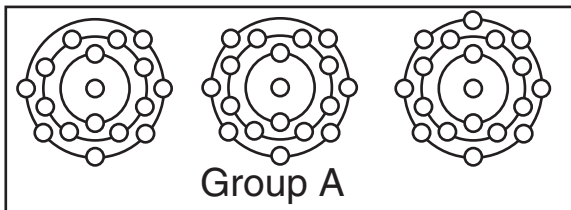
**DIRECTIONS**

Choose the best answer choice for each of the following questions.

1. Most metallic elements have all of these properties EXCEPT \_\_\_\_\_.
- a high melting point
  - being a good conductor of electricity
  - being easily crumbled into pieces
  - a shiny luster

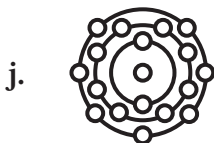
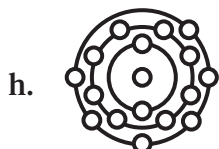
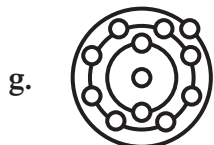
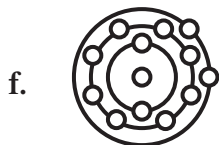


2. Which particle is located in the cloud region of the atom?
- electron
  - neutron
  - nucleus
  - proton



3. The atoms in Group A are different from the atoms in Group B because only the atoms in Group A have \_\_\_\_\_.
- their outer energy levels filled with electrons
  - three energy levels of electrons
  - electron arrangements typical of metals
  - electron arrangements typical of nonmetals

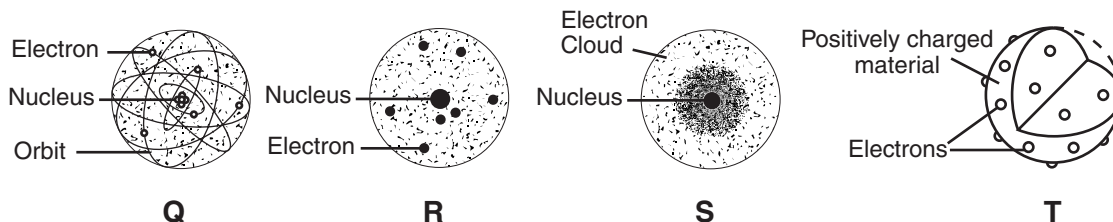
4. Alkali metals belong to a group of elements whose atoms have only one electron in their outer energy level. According to this definition, which of these is an atom of an alkali metal?



### Characteristics of Some Solids

Solid	Atomic Number	Atomic Mass	Color
Rubidium	37	85.5	White
Cesium	55	132.9	Silvery-white
Tantalum	73	180.9	Gray
Thorium	90	232.0	Silvery-white

5. According to this information, which solid has an atomic mass greater than 200?
- rubidium
  - cesium
  - tantalum
  - thorium
6. Which of the following is a major characteristic of a quark?
- one of the most basic types of particles
  - a variety of an element that has different numbers of neutrons
  - a particle in the nucleus that has one of the most significant amounts of mass
  - the smallest atom identified by scientists



7. These pictures show different models of the atom proposed by scientists. Which of these is the correct order, from oldest to most recent?
- R, T, Q, S
  - T, S, R, Q
  - S, R, T, Q
  - R, S, T, Q

**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

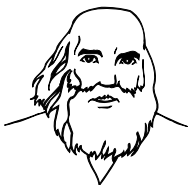
- 1** The periodic table of elements is the most useful tool in chemistry. Which of the following scientists is credited with the development of the periodic table?



**A** Niels Bohr



**B** Albert Einstein

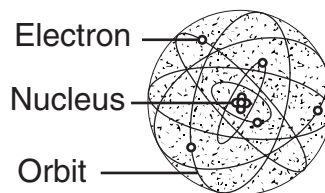


**C** Dimitri Mendeleev

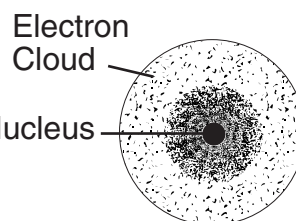


**D** Ernest Rutherford

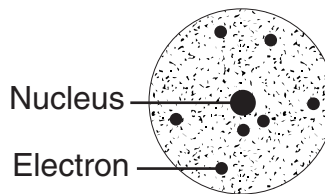
- 2** Which of these diagrams represents the modern model of the atom?



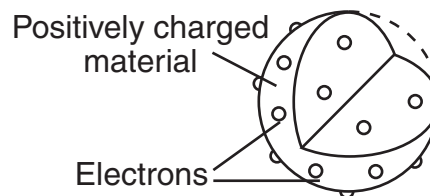
**F**



**G**



**H**

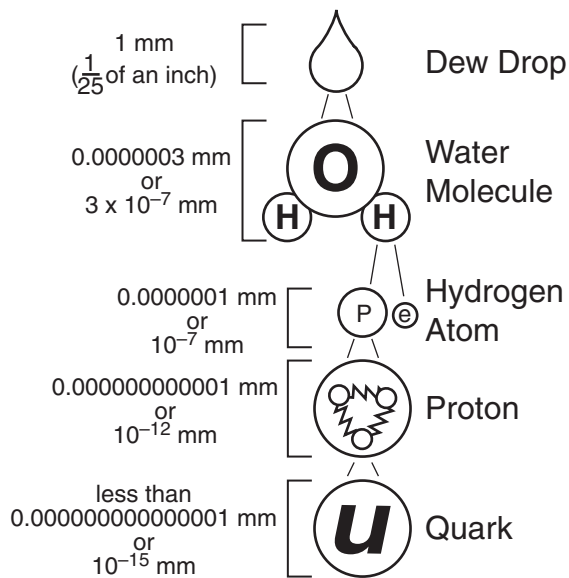


**J**

- 3** Which of these would be the best conductor of electricity?

- A** iodine
- B** silicon
- C** silver
- D** sulfur

**Directions:** Use the information in the diagram to answer Number 4 below.



**4** Which of these statements is not true?

- F** Molecules are made up of atoms.
- G** Protons are smaller than quarks.
- H** Atoms are larger than protons.
- J** Protons are made up of quarks.

**5** Which of the following is not a subatomic particle?

- A** electron
- B** neutron
- C** nucleus
- D** proton

**6** Physicians currently use radioactive isotopes in various medical fields. Some radioactive isotopes are used to

- F** power lasers for surgery
- G** develop new antibiotics
- H** clone organisms
- J** destroy cancer cells

**Directions:** Read Number 7 below. Then, on your answer sheet, write your answer in complete sentences.

**7** Patients with heart disease and high blood pressure are often placed on a salt-free diet. They are instructed that they may use a salt substitute to season their food. A common salt substitute is potassium chloride (KCl). Its chemical formula is very similar to that of everyday table salt, sodium chloride (NaCl). Based on your knowledge of the periodic table, explain why potassium chloride probably has properties similar to those of sodium chloride.

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**DIRECTIONS**

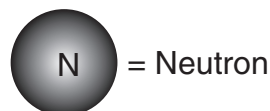
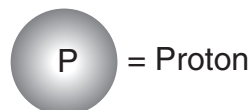
Choose the best answer choice for each of the following questions.


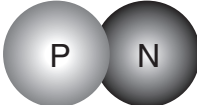
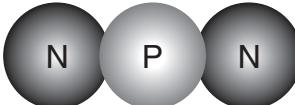
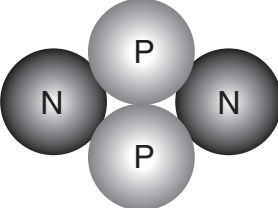
**Half-Life of Carbon-14**

Half-life	Mass of C-14 Remaining (g)	Number of Years
0	1	0
1	$\frac{1}{2}$	5,700
2	$\frac{1}{4}$	11,400
3	$\frac{1}{8}$	17,100
4	$\frac{1}{16}$	22,800
5	$\frac{1}{32}$	?

- According to these data, after how many years would the mass of carbon-14 remaining be  $\frac{1}{32}$  grams?
  - 17,100 years
  - 22,800 years
  - 28,500 years
  - 34,200 years
- A scientist was studying different radioactive samples using a cloud chamber. She looked at the path created by a sample. Which observation would mean that her sample probably contained beta-particle radiation?
  - short, thin trails
  - short, thick trails
  - long, thin trails
  - long, thick trails

- An alpha particle is the same as a helium nucleus and has the symbol  ${}^4_2\text{He}$ . According to this definition, which of these is an alpha particle?



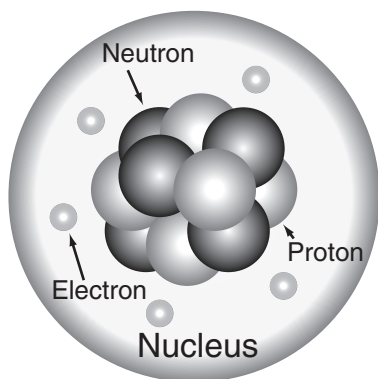
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### Half-Lives of Isotopes Used to Find the Ages of Rocks and Fossils

Isotope	Half-Life
Rubidium-87	50 billion years
Uranium-238	4.5 billion years
Potassium-40	1.4 billion years
Carbon-14	5,730 years

4. According to the chart, the age of the skull of a saber-tooth tiger that died about 30,000 years ago could best be determined by using \_\_\_\_\_.
- rubidium-87
  - uranium-238
  - potassium-40
  - carbon-14

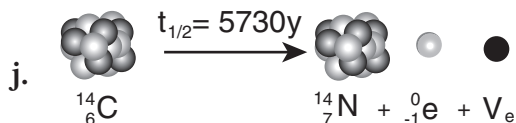
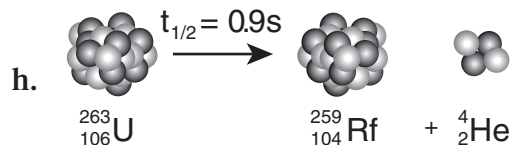
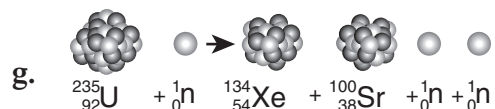
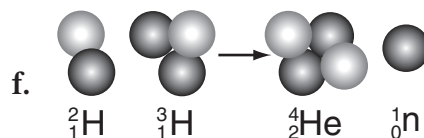


5. What holds the protons and neutrons together in the nucleus of an atom?
- the strong nuclear force
  - the weak nuclear force
  - the electrical force
  - gravity

### Characteristics of Nuclear Fission

- Process of splitting a nucleus into two nuclei with smaller masses.
- Only large nuclei with atomic numbers above 90 can undergo it.
- Products usually include several individual neutrons in addition to the smaller nuclei.

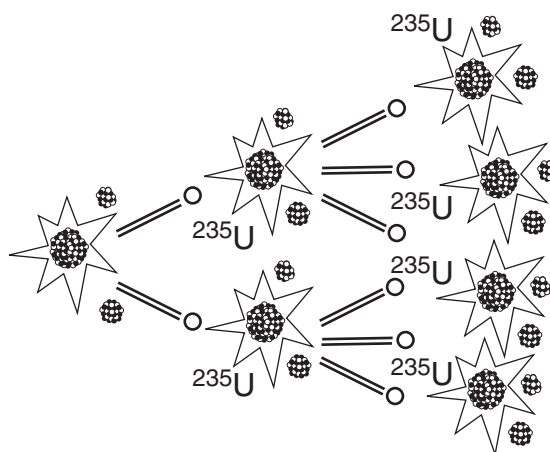
6. According to the above information, which of these best represents nuclear fission?



**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

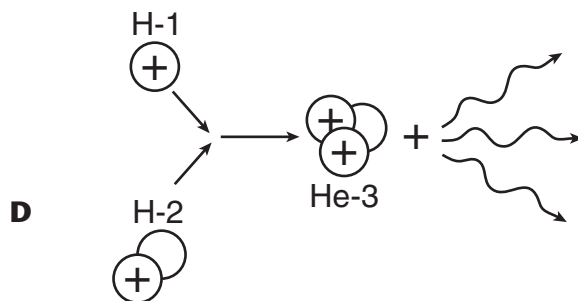
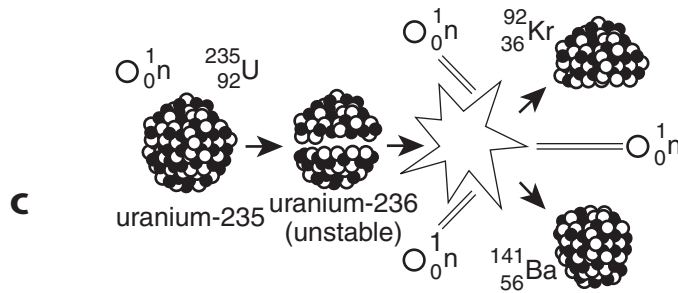
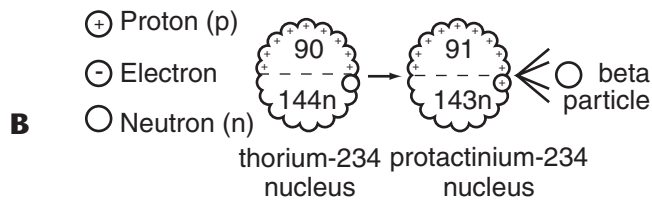
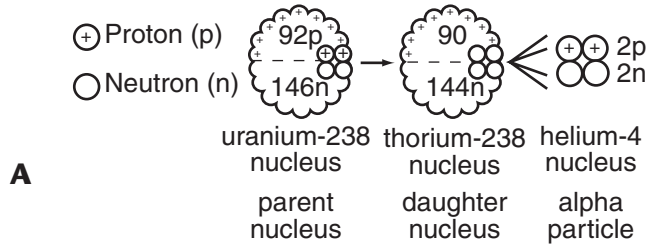
- 1** Which of these is not a type of nuclear radiation?
- A** alpha particles  
**B** beta particles  
**C** gamma rays  
**D** X rays
- 2** Carbon-14 and carbon-12 have the same number of protons but a different number of neutrons. These different forms of the same element are called
- F** radioactive  
**G** isotopes  
**H** nuclei  
**J** tracers
- 3** Medical scientists use radioactive substances to diagnose and treat injury and disease. Cobalt-60, a radioisotope, is used
- A** to destroy cancer cells  
**B** to diagnose thyroid disease  
**C** as a radioactive tracer  
**D** to enhance X-ray images
- 4** Which of these would penetrate a car door made of aluminum?
- F** alpha particles  
**G** beta particles  
**H** gamma rays  
**J** helium nuclei



- 5** Nuclear fission of uranium-235 can start a chain reaction by
- A** releasing enough heat energy to start nuclear fission in neighboring atoms  
**B** producing two smaller atoms that can then strike and split neighboring atoms  
**C** producing neutrons that can then strike and split neighboring atoms  
**D** combining two atoms with low mass to form one large atom
- 6** Which statement provides the best description of transmutation?
- F** Transmutation is the change in genetic material due to radiation.  
**G** Transmutation is the change of one element to another through nuclear decay.  
**H** Nuclear reactors are the cause of all transmutations.  
**J** Transmutation can be speeded up or slowed down by chemical intervention.

**GO ON** 

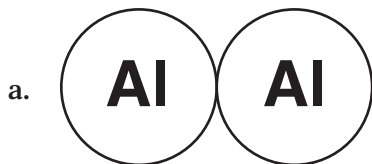
- 7** Which of these diagrams represents the type of nuclear reaction that produces energy in the Sun?



**DIRECTIONS**

Choose the best answer choice for each of the following questions.

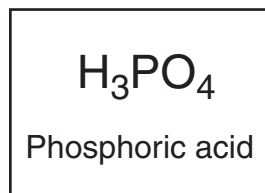
1. A covalent bond forms when two nonmetals share electrons. According to this definition, which of the following is an example of a covalent bond?



2. A student is trying to determine if a particular element is a metal. The element is likely to be a metal if it is \_\_\_\_\_.
- f. malleable
  - g. liquid
  - h. toxic
  - j. hot

3. Which element is an important nutrient for humans?

- a. mercury
- b. calcium
- c. helium
- d. gold

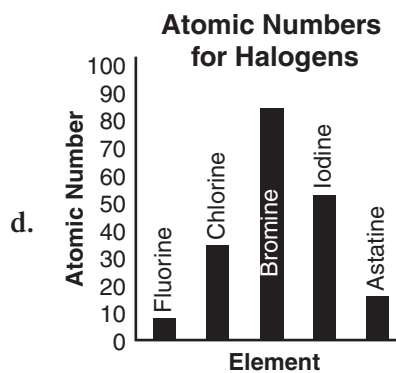
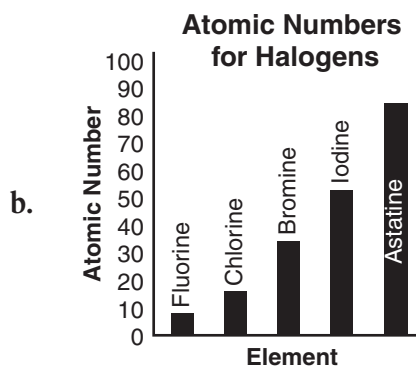
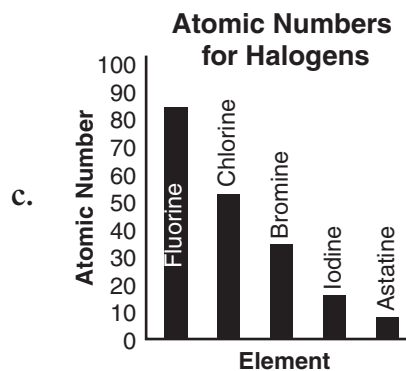
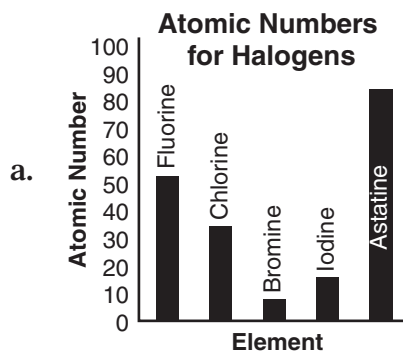


4. According to this chemical formula, all of the following elements are found in phosphoric acid EXCEPT \_\_\_\_\_.
- f. hydrogen
  - g. oxygen
  - h. phosphorus
  - j. potassium

## The Halogens

Element	Atomic Number
Fluorine	9
Chlorine	17
Bromine	35
Iodine	53
Astatine	85

5. The chart shows the atomic numbers for the elements in the halogen family of elements. Which of these graphs best represents these data?

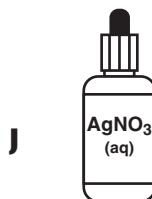
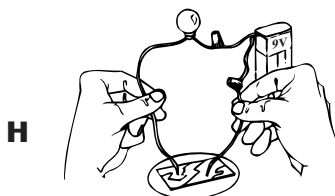


**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

- 1** Which of the following gives the best definition of *allotropes*?
- A** Allotropes are compounds containing the element aluminum.
  - B** Allotropes are elements that conduct electricity.
  - C** Allotropes are different structural forms of the same element.
  - D** Allotropes are two atoms of the same element with different atomic numbers.
- 2** Which element listed below is considered an alkaline earth metal?
- F** oxygen
  - G** magnesium
  - H** chlorine
  - J** hydrogen
- 3** Metals are ductile. This allows them to
- A** be pulled into long wires
  - B** conduct electricity
  - C** melt quickly
  - D** be used to cover floors

- 4** A chemist is trying to identify elements. Which instrument could be used to test a sample of an element for conductivity?



- 5** A student measures the mass of a sample of nickel during science class. She probably recorded her answer in
- A** liters
  - B** tons
  - C** inches
  - D** grams

**Directions:** This chart gives the results of an experiment testing physical and chemical properties of elements. Use the information in the chart to answer Numbers 6–7 below.

Test	Element 1	Element 2	Element 3	Element 4
<b>Conductivity</b>	Yes	Yes	No	No
<b>Physical Appearance</b>	Shiny solid stored in oil	Shiny solid	Colorless Gas	Yellow Gas
<b>Reactivity</b>	Very	Reacts with nonmetals	Unreactive	Reacts with alkali metals

**6** A fifth element also was tested. It did not conduct electricity, it reacted with alkali metals, and it was a gas. This element behaved most similarly to

- F** Element 1
- G** Element 2
- H** Element 3
- J** Element 4

**7** A sixth element also was tested. It conducted electricity, it reacted with nonmetals, and it was a solid. This element behaved most similarly to

- F** Element 1
- G** Element 2
- H** Element 3
- J** Element 4

**Directions:** Read Number 8 below. Then, on your answer sheet, write your answer in complete sentences.

**8** Elements in Group 18 of the periodic table are sometimes called inert gases. Explain why they received this name and what it is about their atomic structure that leads to this.

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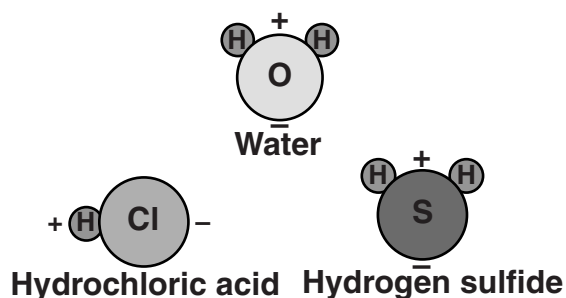


**DIRECTIONS**

Choose the best answer choice for each of the following questions.

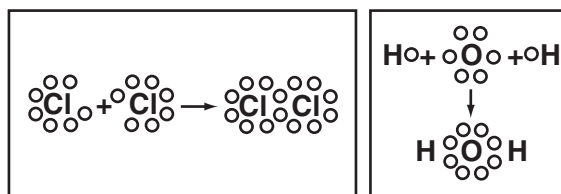
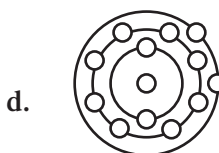
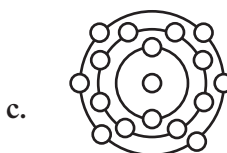
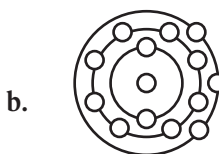
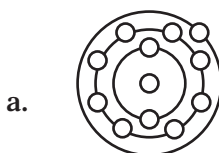
Polyatomic Ions	Not Polyatomic Ions
$\text{NH}_4^+$	$\text{Cl}^-$
$\text{CO}_3^{2-}$	$\text{Na}^+$
$\text{OH}^-$	$\text{Ca}^{2+}$
$\text{PO}_4^{3-}$	$\text{O}^{2-}$

1. According to this information, a polyatomic ion is a \_\_\_\_\_.
- group of ionically bonded atoms with a net charge of zero
  - charged, covalently bonded group of atoms
  - group of covalently bonded atoms with a net charge of zero
  - charged, ionically bonded group of atoms



2. The picture shows models of polar molecules. Which of these is the major characteristic of polar molecules?
- They contain at least two hydrogen atoms.
  - They contain a metal and a nonmetal.
  - They have a triangular shape created by the large size of negative oxygen molecules.
  - They have a slightly positive end and a slightly negative end.

3. All of these atoms lend electrons and form positive ions EXCEPT —



4. Which process is taking place in these chemical combinations?
- electron transfer
  - electron sharing
  - electron gain
  - electron loss

**GO ON**



**Oxidation Numbers**

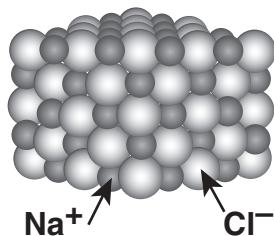
	1+																			0
	1	2+												3+	4+	3-	2-	1-		18
		2												13	14	15	16	17		
1	H																			He
2	Li	Be												B	C	N	O	F		Ne
3	Na	Mg	3	4	5	6	7	8	9	10	11	12	Al	Si	P	S	Cl		Ar	
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br		Kr	
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I		Xe	
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At		Rn	
7	Fr	Ra	Ac	Rf	Ha	106	107	108	109											

5. The diagram shows the oxidation numbers of certain groups in the periodic table. According to the diagram, which group is LEAST likely to combine with other elements to form compounds?
- Group 1
  - Group 14
  - Group 17
  - Group 18
- 
6. Which statement best describes what happens to sodium and chlorine atoms when they combine to form sodium chloride?
- The sodium atom becomes a positive sodium ion, and the chlorine atom becomes a negative chloride ion.
  - The sodium atom becomes a negative sodium ion, and the chlorine atom becomes a positive chloride ion.
  - The sodium atom becomes a positive chloride ion, and the chlorine atom becomes a negative sodium ion.
  - The sodium atom becomes a negative chloride ion, and the chlorine atom becomes a positive sodium ion.
7. A student heated a blue copper sulfate crystal in a test tube. After a few minutes, she observed that the crystal turned white and the inside of the test tube was covered with a thin film of water. The water inside the test tube most likely \_\_\_\_\_.
- was left from cleaning the test tube the night before
  - condensed from the air around the test tube
  - came from the blue copper sulfate crystal, which is a hydrate
  - seeped through the sides of the test tube



**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.



**1** Which of the following is the reason why atoms of sodium and chlorine attract each other in a salt crystal?

- A** Sodium has a positive charge and chlorine has a negative charge.
- B** Sodium has a negative charge and chlorine has a positive charge.
- C** Both have a positive charge.
- D** Both have a negative charge.

**Carbonate** ( $\text{CO}_3^{2-}$ )

**Hydroxide** ( $\text{OH}^-$ )

**Ammonium** ( $\text{NH}_4^+$ )

**Sulfate** ( $\text{SO}_4^{2-}$ )

**2** Many ionic compounds contain charged, covalently bonded groups of atoms that act like a single atom. These groups are called

- F** hydrates
- G** binary compounds
- H** polar molecules
- J** polyatomic ions

**3** Calcium is a metal with an oxidation number of  $2^+$ . Chlorine is a nonmetal with an oxidation number of  $1^-$ . Which of these would be the chemical formula for the compound formed by these two elements?

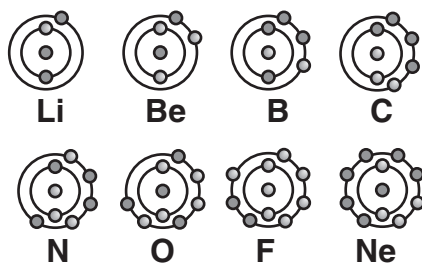
- A**  $\text{CaCl}$
- B**  $\text{CaCl}_2$
- C**  $\text{Ca}_2\text{Cl}$
- D**  $\text{CaCl}_3$

**4** Which of the following may be classified as a binary compound?

- F**  $\text{H}_2\text{SO}_4$
- G**  $\text{NH}_4\text{Cl}$
- H**  $\text{Mg}(\text{OH})_2$
- J**  $\text{NaCl}$

**5** Ionic compounds are usually formed by ionic bonding between metals and nonmetals. Which of the following is not an ionic compound?

- A**  $\text{NaBr}$
- B**  $\text{MgCl}_2$
- C**  $\text{HCl}$
- D**  $\text{KI}$



- 6** The elements whose atoms are pictured above all belong to period 2 of the periodic table. It would require the greatest energy to remove an electron from which element?

**F** Li  
**G** N  
**H** F  
**J** Ne

- 7** Which statement provides the best description of a covalent bond?

**A** A covalent bond is the attraction between atoms when they share electrons.  
**B** A covalent bond is the attraction between opposite charges of ions in a compound.  
**C** A covalent bond usually forms between a metal and a nonmetal.  
**D** A covalent bond is usually stronger than an ionic bond.

- 8** The noble gases rarely combine with other elements to form compounds because

**F** they are gases  
**G** their outer energy levels are full  
**H** their atoms are much too large  
**J** they are nonmetals

**Directions:** Read Number 9 below. Then, on the lines that follow, write your answer in complete sentences.

- 9** Use what you know about chemical bonds to explain why noble gases are more stable than other elements. Use the term “energy level” in your explanation.

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**DIRECTIONS**

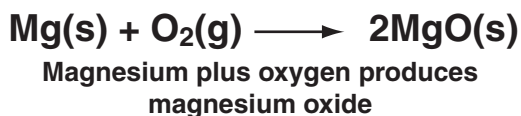
Choose the best answer choice for each of the following questions.

1. Antoine Lavoisier is credited with the discovery of the law of conservation of mass. This law states that in a chemical reaction, matter is not created or destroyed, but preserved. Which of the following equations correctly models this law?

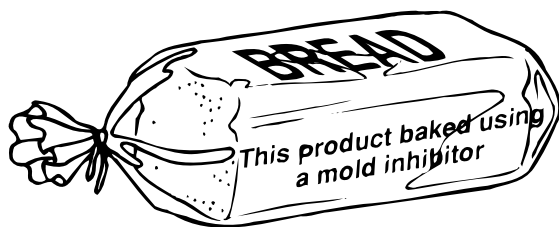
- a.  $\text{H}_2 + \text{Cl}_2 \longrightarrow 2\text{HCl}$
- b.  $\text{H}_2 + \text{Cl}_2 \longrightarrow \text{HCl}$
- c.  $\text{H} + \text{Cl} \longrightarrow 2\text{HCl}$
- d.  $2 \text{H}_2 + \text{Cl}_2 \longrightarrow 2\text{HCl}_2$



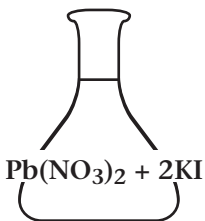
2. The green color of the copper coating that covers the Statue of Liberty is different from the color of a typical copper penny. What caused the Statue of Liberty's copper coating to turn green?
- f. Copper corrodes when exposed to air, creating copper carbonate.
  - g. Erosion wore away the outer layer of copper, exposing its copper carbonate interior.
  - h. Copper exposed to air and moisture forms hydrated iron (III) oxide.
  - j. Copper exposed to air produces a protective carbonate covering.



3. The equation above is not balanced. In order to balance the equation, a coefficient of 2 needs to be placed directly \_\_\_\_\_.
- a. after the symbol for magnesium on the left side of the equation
  - b. before the symbol for oxygen on the left side of the equation
  - c. after the symbol for oxygen on the left side of the equation
  - d. before the symbol for magnesium on the left side of the equation
4. The process by which hydrogen and oxygen form water can be classified as a \_\_\_\_\_.
- f. decomposition reaction
  - g. synthesis reaction
  - h. precipitate reaction
  - j. single-displacement reaction



5. The information on this bread bag means that the bread is baked using \_\_\_\_\_.
- all natural ingredients
  - an ingredient that encourages the rising of yeast
  - an ingredient that helps prevent the growth of fungus
  - several different types of preservatives

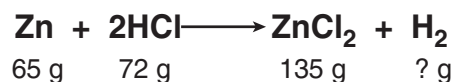


6. A coefficient in the above formula is \_\_\_\_\_.
- Pb
  - (NO<sub>3</sub>)
  - 2
  - KI

7. Which of these is NOT evidence of a chemical reaction?
- An iron nail changes to a brownish-orange color.
  - An ice cube melts into liquid water.
  - An antacid tablet produces bubbles of gas when placed in water.
  - A piece of zinc raises the temperature of an acid as it reacts with it.



8. The diagram shows an equation representing a chemical reaction. In this equation, which of these are the reactants?
- HCl and NaOH
  - NaCl and H<sub>2</sub>O
  - HCl and H<sub>2</sub>O
  - NaOH and NaCl



9. The law of conservation of mass states that in a chemical reaction the mass of the reactants equals the mass of the products. Based on this information, what mass of hydrogen (H<sub>2</sub>) was produced in this reaction?
- 2 g
  - 4 g
  - 72 g
  - 144 g

**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

**Activity Series of Metals**

Lead Copper Mercury Silver Gold

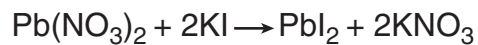
**Most  
Active****Least  
Active**

- 1** Knowing that a more active metal will replace a less active metal in a compound, which of the following statements is true?
- A** Gold would replace silver.  
**B** Mercury would replace lead.  
**C** Silver would replace copper.  
**D** Lead would replace copper.
- 2** A double-displacement reaction occurs if water, gas, or a precipitate (insoluble compound) forms when two ionic compounds in solution are combined. Which of the following is the generalized formula for this type of reaction?
- F**  $AB + CD \longrightarrow AD + CB$   
**G**  $A + BC \longrightarrow AC + B$   
**H**  $D + BC \longrightarrow BD + C$   
**J**  $A + B \longrightarrow AB$
- 3** Which of these is a reason a catalyst is added to a chemical reaction?
- A** to stabilize a substance  
**B** to speed up a reaction  
**C** to produce a greater amount of the catalyst  
**D** to prevent a compound from forming
- 4** When a wood fire burns, it releases heat into the environment. This type of reaction is
- F** endothermic  
**G** exothermic  
**H** catalytic  
**J** endergonic
- 5** Jodi wants to test the law of conservation of mass by performing an experiment with charcoal. Which of the following instruments should she use to weigh her materials?
- A** ammeter  
**B** volumetric flask  
**C** triple-beam balance  
**D** Bunsen burner

**GO ON** 

**6** Some reactions require an input of energy in order to occur. Photosynthesis, the process in which plants use light to make sugars, requires an energy input. This reaction would be classified as

- F** endergonic
- G** exergonic
- H** synthetic
- J** exothermic



**7** Which of these is a product?

- A**  $\text{Pb}(\text{NO}_3)_2$
- B**  $\text{PbI}_2$
- C**  $\text{Pb}$
- D**  $\text{KI}$

**Directions:** Read Number 8 below. Then, on the lines that follow, write your answer in complete sentences.

**8** Describe an experiment in which you demonstrate the validity of the law of conservation of mass.

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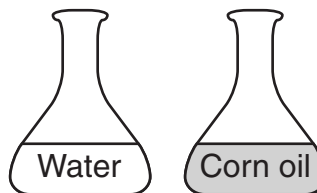
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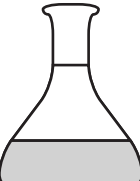



**DIRECTIONS**

Choose the best answer choice for each of the following questions.

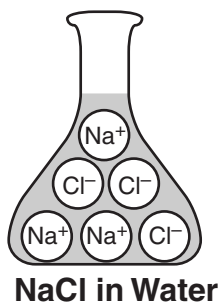
- Which of the following is NOT a good example of a solute and solvent in solution?
  - a solution of a kilogram of water and a gram of salt
  - a solution of a gram of silver and a milligram of copper
  - a solution of a kilogram of cold water and a kilogram of hot water
  - a solution of a kilogram of water and a milligram of sugar
- Michelle wants to quickly dissolve powdered drink mix in a pitcher of water. All of the following are ways in which she could increase the rate of dissolution EXCEPT \_\_\_\_\_.
  - heating the mixture
  - stirring the mixture
  - breaking up big pieces of the powdered drink mix
  - adding more powdered drink mix



- The picture above shows two separate containers. One contains water, a polar substance, and the other contains corn oil, a nonpolar substance. Which of these shows what the contents of the flask will look like when the corn oil is poured into the flask of water?
  - 
  - 
  - 
  - 



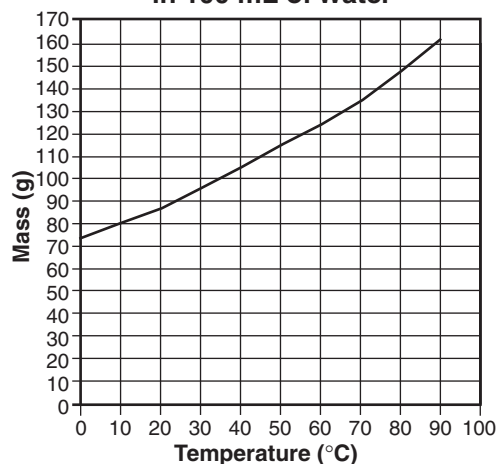
4. Information about the amount of salt that will dissolve in a liter of water at 20°C would most likely be found in which kind of table?
- solubility
  - polarity
  - solvent properties
  - temperature
5. Janelle added salt to a beaker of water until she could still see salt crystals, even after stirring. This type of solution is called \_\_\_\_\_.
- an unsaturated solution
  - a saturated solution
  - a soluble solution
  - a supersaturated solution



6. According to the diagram, which statement best describes the process that occurs when sodium chloride is placed in water?
- The sodium chloride becomes the solvent.
  - The sodium chloride dissociates into ions.
  - The sodium chloride becomes nonpolar.
  - The sodium chloride forms an alloy.

7. Sashia is about to conduct an experiment. She has set up four beakers. In the first beaker, she plans to add a single ice cube. In the second beaker, she plans to add an ice cube split in half. In the third beaker, she plans to add an ice cube split into quarters. In the fourth beaker, she plans to add a crushed ice cube. Sashia's laboratory setup was most likely designed to show that \_\_\_\_\_.
- increasing the surface area speeds up the rate of melting
  - increasing the mass slows down the rate of melting
  - increasing the temperature speeds up the rate of melting
  - increasing the volume of water speeds up the rate of melting

**Mass of Sodium Nitrate that Can Be Dissolved in 100 mL of Water**



8. Based on the information in the graph, what is the approximate number of grams of sodium nitrate that can be dissolved in water at a temperature of 70°C?
- 125 g
  - 135 g
  - 140 g

**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

**1** Which of the following is not a solution?

- A** a mixture of nitrogen, oxygen, and argon
- B** a liter of sugary water
- C** a necklace made of copper and gold
- D** a liter of mercury

**2** Which of these best describes the process of ionization?

- F** Water pulls apart a molecule into ions.
- G** Water cannot easily mix with oil.
- H** Water will only hold so much salt before the solution becomes saturated.
- J** Water cannot pull apart a molecule.

**3** Which of the following would be least likely to help sugar dissolve in water?

- A** warming the solution
- B** shaking or stirring the solution
- C** cooling the solution
- D** crushing large sugar crystals

**Directions:** Jillian and Chris wanted to compare the maximum amounts of sugar and baking soda that will dissolve in water. This table shows their results. Read the table. Then use the information in the table to complete Numbers 4–5 below.

**Solubility of Sugar and Baking Soda in Water at 20°C**

Substance	Solubility in 100g of Water
Sugar	203.9 g
Baking soda	9.6 g

**4** If Jillian dissolves 100 grams of sugar in the same amount of water, this would result in

- F** a saturated solution
- G** an unsaturated solution
- H** a supersaturated solution
- J** a nonpolar solution

**5** If Chris dissolves 9.6 grams of baking soda in the same amount of water, this would result in

- A** a saturated solution
- B** an unsaturated solution
- C** a supersaturated solution
- D** a nonpolar solution



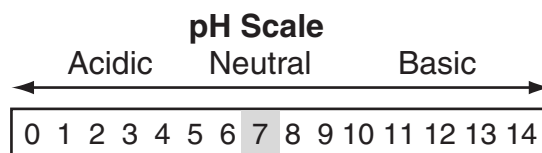
**DIRECTIONS**

Choose the best answer choice for each of the following questions.



- The equations above show two bases reacting with water. Which of these is the major characteristic of bases?
  - They form  $\text{OH}^-$  ions in solution.
  - They contain many sodium atoms.
  - They are gases.
  - They release protons.
- Dan wanted to find out which hand soap produced the most lather and bubbles. He made four different soaps, using a different base for each one. Then he tested how much lather was produced by washing his hands in hot water for different lengths of time with each soap. Dan's experiment could be improved by \_\_\_\_\_.
  - weighing the soaps before and after he was done
  - using hotter water while he washed his hands
  - washing his hands for the same length of time with each soap
  - using more soap and water as he washed his hands with each soap

- All of the following are properties of an acid EXCEPT \_\_\_\_\_.
  - producing hydrogen ions in solution
  - burning a hole through metal
  - tasting sour
  - feeling slippery



- According to the scale, which of the following pH measurements is basic?
  - 7.0
  - 9.5
  - 5.5
  - 1.2
- Which of the following instruments could tell you how acidic a sample of stream water is?
  - anemometer
  - oscilloscope
  - pH meter
  - voltmeter

6. Fish tank water must be kept at a particular pH level so the fish stay healthy. What is the best way to protect the water from becoming too acidic or too basic?
- Add a buffer to the water.
  - Put pH paper on the tank.
  - Add acid to the water.
  - Fill the tank with colored water.
- $$\text{H}_2\text{SO}_4 + \text{KOH} \longrightarrow \text{K}_2\text{SO}_4 + \text{H}_2\text{O}$$
7. The chemical equation shown above is a neutralization reaction. Which formula represents a salt?
- $\text{H}_2\text{SO}_4$
  - $\text{KOH}$
  - $\text{K}_2\text{SO}_4$
  - $\text{H}_2\text{O}$
8. Mershum and his teacher are conducting a titration experiment. Mershum is adding an indicator into the solution drop by drop. Mershum knows that he should stop adding drops of the indicator when the solution \_\_\_\_\_.
- becomes clear
  - changes color
  - evaporates
  - bubbles
9. An aqueous solution of which of the following compounds will change red litmus paper to blue?
- $\text{HCl}$
  - $\text{H}_2\text{O}$
  - $\text{NaCl}$
  - $\text{NaOH}$
10. When Maria adds a few drops of bromthymol blue to a beaker of water, the resulting solution has a blue color. Next, as she blows exhaled air into the solution through a straw, Maria observes a series of color changes—blue to blue-green, to green, to yellow-green, and finally to yellow. Which of these is the most likely cause of these color changes?
- The carbon dioxide in the exhaled air dissolves in water to form a weak acid.
  - The carbon dioxide in the exhaled air dissolves in water to form a weak base.
  - The oxygen in the exhaled air dissolves in water to form a weak acid.
  - The oxygen in the exhaled air dissolves in water to form a weak base.

**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.



- 1** Antacids contain bases that react with the acid in your stomach to relieve indigestion. In the reaction above,  $\text{NaHCO}_3$  reacts with the strong hydrochloric acid,  $\text{HCl}$ , to form a salt, carbon dioxide, and water. This type of reaction is called

- A** neutralization
- B** oxidation
- C** dehydration
- D** titration

**Some Common Acid-Base Indicators**

Indicator	Color change	pH range
Thymol Blue	orange	1.2–2.8
Bromphenol Blue	green-blue	3.1–4.7
Bromcresol Purple	yellow-purple	5.3–6.6
Phenolphthalein	light red	8.3–9.9

- 2** Which of the following statements is false?
- F** Bromcresol Purple turns yellow-purple at pH 5.8.
  - G** Thymol Blue turns orange at pH 2.
  - H** Phenolphthalein turns light red at pH 8.2.
  - J** Bromphenol Blue turns green-blue at pH 4.6.

**pH of Acidic Solutions**

Solutions	pH
Gastric (stomach) Juice	1.5
Cola	3
Acid Rain	4.2
Pure Rainwater	5.6

- 3** Mr. Vasquez's chemistry class made a list of some solutions and their pH levels. The table above shows their results. Which of the following sequences shows these solutions, in order of least acidic to most acidic?
- A** gastric juice, cola, acid rain, pure rainwater
  - B** cola, acid rain, gastric juice, pure rainwater
  - C** pure rainwater, acid rain, cola, gastric juice
  - D** acid rain, pure rainwater, gastric juice, cola

**4** Adding which of the following to a pond would be least likely to harm the fish and other organisms living there?

- F** hydrochloric acid
- G** buffer
- H** drain cleaner
- J** ammonia

**5** Lye, a substance used in making soap, has a pH of 13. A substance with a pH of 13 is best described as

- A** acidic
- B** basic
- C** neutral
- D** strongly acidic

**6** Which of the following is not a way in which acid rain affects the environment?

- F** contaminating streams
- G** washing away minerals from soil
- H** corroding building surfaces
- J** producing fossil fuels

**Directions:** Read Number 7 below. Then, on the lines that follow, write your answer in complete sentences.

**7** The most acidic rainfall ever recorded fell in Wheeling, West Virginia. The pH of this rain was 1.5. Normal rain has a pH of approximately 5.6. Explain why acid rain is harmful to waterways, animals, and plants.

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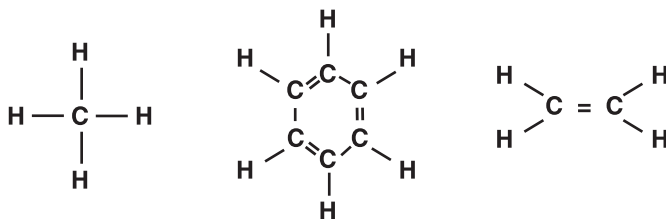


**DIRECTIONS**

Choose the best answer choice for each of the following questions.

1. The element carbon exists naturally in all of the following forms EXCEPT \_\_\_\_\_.
  - a. charcoal
  - b. graphite
  - c. metal
  - d. diamond
  
2. Proteins have all of the following characteristics EXCEPT being \_\_\_\_\_.
  - f. made of amino acids
  - g. inorganic compounds
  - h. able to fold into different shapes
  - j. the most common component of your body except water
  
3. Petroleum is a type of fossil fuel. According to this definition, where does petroleum come from?
  - a. a type of moss that lives in dark caves
  - b. deep ocean vents
  - c. asteroids that have crashed to Earth
  - d. the remains of long-dead plants and animals

4. The picture below shows models of some organic compounds. According to the diagram, which of these is a major characteristic of organic compounds?



- f. They contain five atoms.
- g. They contain carbon atoms.
- h. They have a basic ring shape.
- j. They interact with nitrogen.



Carbon Bond Type	Compound
Single Bond	Methane, Propane, Butane
Double Bond	Ethene
Triple Bond	Ethyne
Ring	Benzene
Fused Ring	Naphthalene

5. According to the information in the table, in which compound are carbon molecules joined by a double bond?
- methane
  - naphthalene
  - ethyne
  - ethene

6. All of the following materials are organic compounds EXCEPT \_\_\_\_\_.

- hydrogen
- nucleic acids
- lipids
- cholesterol

7. Information about alcohols and organic acids would most likely be found under which heading in a table of contents?

- The Funny Shapes of Fused Rings
- The Uses of Substituted Hydrocarbons
- The Underground Life of Petroleum
- The Math of Saturation

8. There are over four million organic compounds. The element carbon forms so many compounds because \_\_\_\_\_.

- carbon atoms have low ionization energy
- carbon atoms have high electronegativity
- carbon atoms readily form ionic bonds with other carbon atoms
- carbon atoms readily form four covalent bonds with other atoms

9. Which of the following formulas represents an organic acid?

- $\text{CH}_3\text{OH}$
- $\text{CH}_3\text{OCH}_3$
- $\text{CH}_3\text{COOH}$
- $\text{CH}_3\text{COOCH}_3$



**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

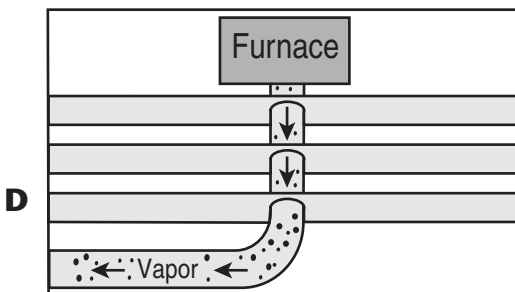
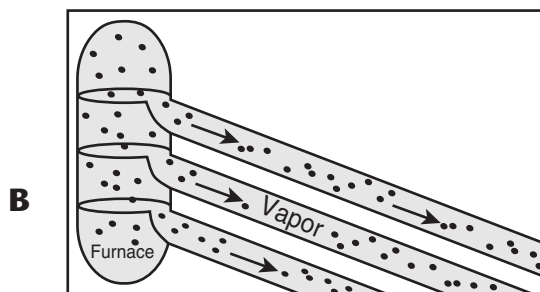
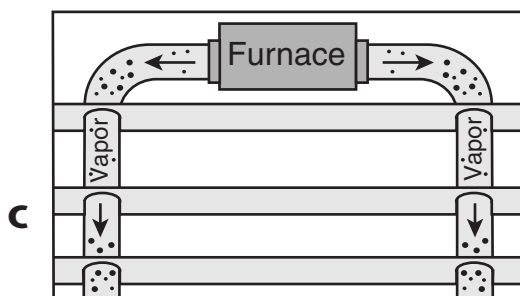
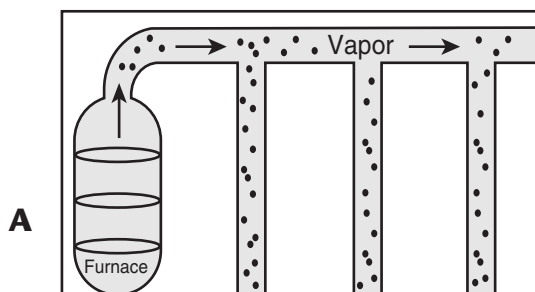
**1** Butane and isobutane are isomers. Isomers are compounds with

- A** identical chemical formulas but different molecular structures
- B** identical molecular structures but different chemical formulas
- C** identical chemical formulas and molecular structures
- D** different chemical formulas and molecular structures

**2** Organic materials contain carbon. There are many different kinds of organic materials. This is because carbon

- F** is a very light element
- G** is the most common element
- H** forms many types of bonds
- J** all of the above

**3** An oil refinery separates petroleum into different carbon compounds by boiling it and allowing the oil to vaporize. Which of the following illustrates a typical oil refinery?



**4** While discussing aromatic compounds, Akira's teacher passed around a vial full of a sour-smelling liquid. Besides having an acrid smell, aromatic compounds also have which of the following characteristics?

- F** very high boiling point
- G** moderate viscosity
- H** ring structure
- J** made of proteins

**5** Which statement best describes a hydrocarbon?

- A** A hydrocarbon is a molecule that contains carbon.
- B** A hydrocarbon is a molecule that contains carbon and hydrogen.
- C** A hydrocarbon is a molecule that contains hydrogen.
- D** A hydrocarbon is an inorganic compound that contains carbon.

**Directions:** Read Numbers 6–7 below. Then, on the lines that follow, write your answers in complete sentences.

**6** Many biological compounds are made of polymers. What is a polymer? Describe the structure of a polymer.

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**7** Compare and contrast two similar biological polymers, proteins and nucleic acids. Then compare and contrast their respective monomers, amino acids and nucleotides.

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**DIRECTIONS**

Choose the best answer choice for each of the following questions.

- An alloy is a mixture of one or more types of what material?
  - plastic
  - ceramic
  - metal
  - polymer

**Properties of Alloys**

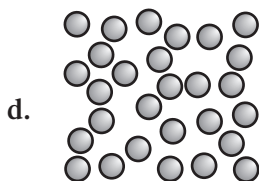
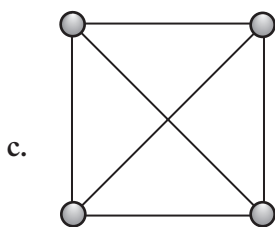
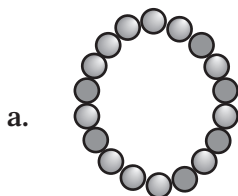
Alloy	Properties
Manganese Steel	Hard
Duriron	Acid Resistant
Invar	Does Not Expand or Contract
Stainless Steel	Corrosion Resistant

- Which of the alloys in the table above would make a good storage container for vinegar?
  - manganese steel
  - Duriron
  - Invar
  - stainless steel
- Most ceramics have all of these properties EXCEPT \_\_\_\_\_.
  - ability to withstand high temperatures
  - strength
  - brittleness
  - malleability

- Plastic is usually made of what kind of material?
  - alloy
  - ceramic
  - composite
  - polymer
- Which of the following is LEAST likely to result from sports technology?
  - Improved safety levels
  - Heavier athletic equipment
  - Stronger athletic equipment
  - Broken records
- Under which heading in a table of contents would the most information about reinforced polymers be found?
  - Ceramics and the Human Body
  - The History of Brass
  - The Strength of Silk
  - Composites



7. A polymer is composed of a chain of monomers. Which of the choices listed below best illustrates how monomers are connected to form polymers?



8. An aerospace company has researched and developed a new alloy. Which of the following properties is LEAST important in deciding whether this new alloy should be used in the construction of jet fighters?

- f. Strong
- g. Lightweight
- h. Acid resistant
- j. Heat resistant

LUSTER	MALLEABILITY	DUCTILITY
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9. Which of these belongs with the group above?
- a. Reinforced polymer
  - b. Mercury
  - c. Synthetic
  - d. Conductivity

**DIRECTIONS**

Read each question. Then, on your answer sheet, mark the answer choice that you think is best.

**Constituents of Alloys**

Alloy	Constituents
Manganese Steel	Iron and Manganese
Bronze	Copper and Tin
Pewter	Tin, Copper, and Antimony
Stainless Steel	Iron, Chromium, and Nickel

- 1** A class is doing an experiment on alloys to determine their composition. Sample A was found to contain iron and manganese. Which of the following alloys is Sample A?

**A** manganese steel  
**B** bronze  
**C** pewter  
**D** stainless steel

- 2** Many modern materials are combinations of other materials. These materials are called

**F** composites  
**G** metals  
**H** elements  
**J** substances

- 3** Joan needs to classify a substance. Through experimentation, she finds that the material is lustrous, malleable, and conducts electricity. Joan therefore identifies the substance as a

**A** gas  
**B** ceramic  
**C** metal  
**D** solid

- 4** Brass is a mixture of copper and zinc. Therefore, brass is

**F** a metal  
**G** a material  
**H** an object  
**J** an alloy

- 5** Which statement best describes a polymer?

**A** A polymer is made of loops of monomers.  
**B** A polymer is made of long chains of monomers.  
**C** A polymer is made of squares of monomers.  
**D** A polymer is made of polymerase.

**6** The sport of tennis has changed as the materials used to make tennis rackets have changed. Which of the following materials might improve a tennis racket?

- F** cement
- G** coal
- H** plastic
- J** glass

**7** During the Bronze Age, bronze was developed and became widely used. What are the components of bronze?

- A** copper and iron
- B** copper and tin
- C** copper and zinc
- D** copper and steel

**Directions:** Read Numbers 8–9 below. Then, on the lines that follow, write your answers in complete sentences.

**8** Ceramics are important materials in everyday life. Discuss some properties of ceramics.

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**9** Synthetic materials make up most of the objects around you. What are synthetic materials? Why are they desirable? List some synthetic materials.

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