

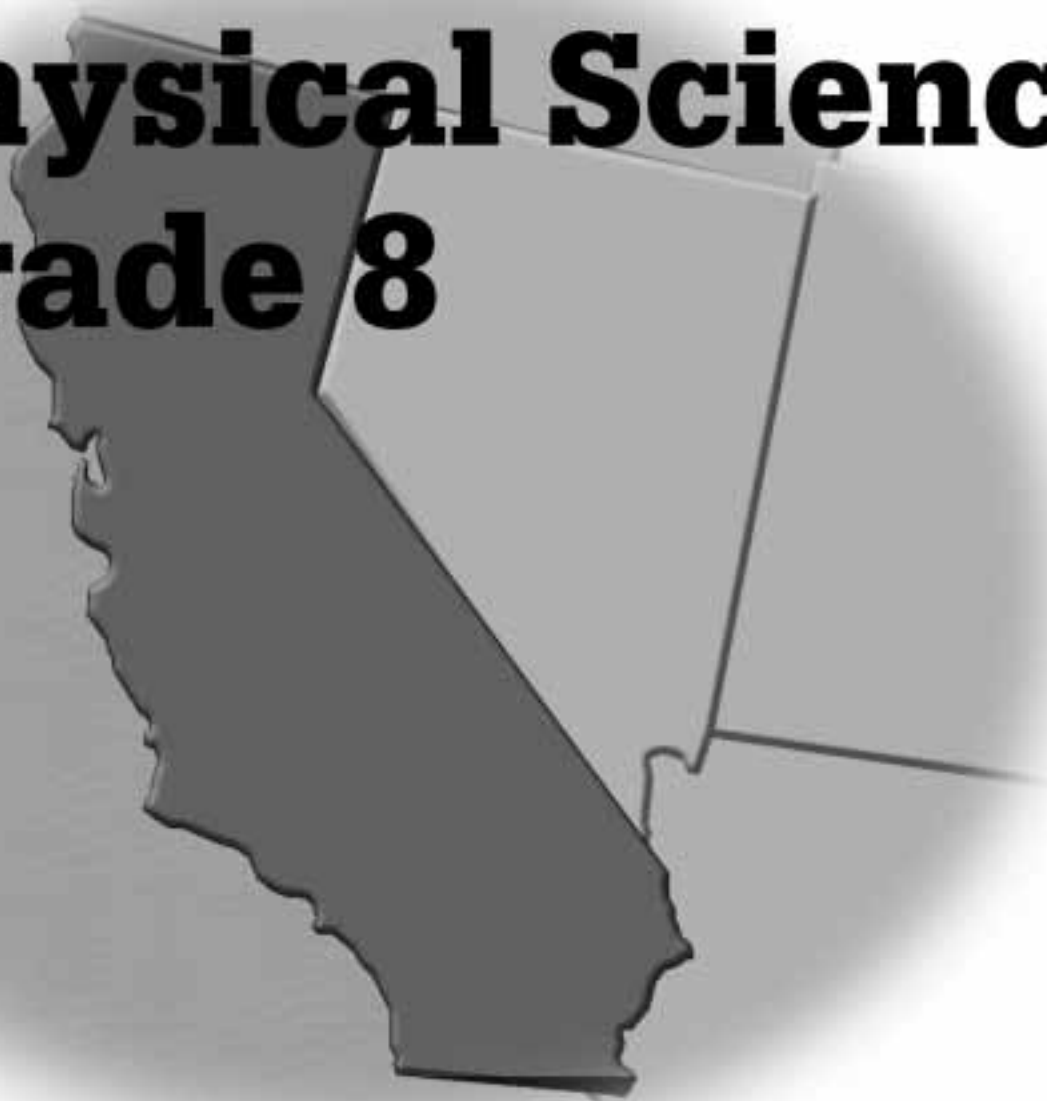
# **Mastering the California Science Content Standards: Focus on Physical Science**

**Grade 8**

## **Features & Benefits**

- Correlated to the California Science Content Standards: Focus on Physical Science
- Provides Diagnostic Test to evaluate students' knowledge
- Provides Standards Practice for all California Science Content Standards
- Provides Self-Assessment Test to assess students' mastery of California Science Content Standards

**Mastering the  
California Standards:  
Focus on  
Physical Science  
Grade 8**



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8787 Orion Place  
Columbus, OH 43240-4027

ISBN: 978-0-07-879367-7  
MHID: 0-07-879367-X

Printed in the United States of America.

1 2 3 4 5 6 7 8 9 10 045 12 11 10 09 08 07

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## Overview

The material in this booklet is designed to help you prepare for the Grade 8 California physical science standards test.

It contains:

- a Student Recording Chart,
- the California Science Standards, Grade 8
- a Diagnostic Test,
- Standards Practice for each objective, and
- a Self-Assessment Test.

## How to Use this Book

**Diagnostic Test** This test will help you identify any weaknesses you may have as you prepare to take the California physical science standards test. Once you've taken the Diagnostic Test and it's been graded, complete the Student Recording Chart on page vi. Mark an X in the square for each question you answer incorrectly.

**Standards Practice** If you missed one or two of the questions for a particular objective, you could probably use some extra practice with that objective. The Student Recording Chart lists practice pages for each objective. Complete the appropriate practice pages. If you are unsure about how to do some of the problems, you may want to refer to your science book.

**Self-Assessment Test** After you have completed your practice worksheet(s), take the Self-Assessment Test on pages 33 to 43.

## Test-Taking Tips

### Before the Test:

1. Be sure to get plenty of sleep the week before the test. A healthy amount of sleep is eight to nine hours every night.
2. On 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 often can hamper your memory and make you tired.
3. On the morning of the test, eat a healthy breakfast with fresh foods that are high in protein and carbohydrates.
4. On 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.

### 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 at guessing correctly and obtaining more points.

Name \_\_\_\_\_

## Student Recording Chart

**Directions:** Circle each question from the Diagnostic Test that you answered *incorrectly*. If there are one or two circles marked for an indicator, write *Yes* in the *Need Practice?* box. Then complete the practice pages for that indicator.

Indicator	1. a.	1. b.	1. c.	1. d.	1. e.	1. f.
<b>Test Questions</b>	5	2, 15	21, 42	10	52	38
<b>Need Practice?</b>						
<b>Practice Pages</b>	13	13	14	14	14	15

Indicator	2. a.	2. b.	2. c.	2. d.	2. e.	2. f.	2. g.
<b>Test Questions</b>	1	24	61	29	40, 49	62	18, 56
<b>Need Practice?</b>							
<b>Practice Pages</b>	16	16	16	17	17	18	18

Indicator	3. a.	3. b.	3. c.	3. d.	3. e.	3. f.
<b>Test Questions</b>	16, 51	47, 50	34	63	43, 55, 60	11
<b>Need Practice?</b>						
<b>Practice Pages</b>	19	20	20	20, 21	21	21

Indicator	4. a.	4. b.	4. c.	4. d.	4. e.
<b>Test Questions</b>	53	3, 44	30	64	6, 25
<b>Need Practice?</b>					
<b>Practice Pages</b>	22	22	22	23	23

Name \_\_\_\_\_

## Student Recording Chart *(continued)*

Indicator	5. a.	5. b.	5. c.	5. d.	5. e.
<b>Test Questions</b>	22, 31	27, 46	59	54	28
<b>Need Practice?</b>					
<b>Practice Pages</b>	24	24	24	24, 25	25

Indicator	6. a.	6. b.	6. c.
<b>Test Questions</b>	9, 39	14	12
<b>Need Practice?</b>			
<b>Practice Pages</b>	26	26	26

Indicator	7. a.	7. b.	7. c.
<b>Test Questions</b>	35, 45	13	58
<b>Need Practice?</b>			
<b>Practice Pages</b>	27	27	28

Indicator	8. a.	8. b.	8. c.	8. d.
<b>Test Questions</b>	65	41	8, 17	23, 48
<b>Need Practice?</b>				
<b>Practice Pages</b>	29	29	29	29

Indicator	9. a.	9. b.	9. c.	9. d.	9. e.	9. f.	9. g.
<b>Test Questions</b>	19	4	36	66	7, 37	20, 26	32, 33, 57
<b>Need Practice?</b>							
<b>Practice Pages</b>	30	30	31	31	32	33	34

## California Standards for Focus on Physical Science

### Motion

1. **The velocity of an object is the rate of change of its position. As a basis for understanding this concept:**
  - a. *Students know* position is defined in relation to some choice of a standard reference point and a set of reference directions.
  - b. *Students know* that average speed is the total distance traveled divided by the total time elapsed and that the speed of an object along the path traveled can vary.
  - c. *Students know* how to solve problems involving distance, time, and average speed.
  - d. *Students know* the velocity of an object must be described by specifying both the direction and the speed of the object.
  - e. *Students know* changes in velocity may be due to changes in speed, direction, or both.
  - f. *Students know* how to interpret graphs of position versus time and graphs of speed versus time for motion in a single direction.

### Forces

2. **Unbalanced forces cause changes in velocity. As a basis for understanding this concept:**
  - a. *Students know* a force has both direction and magnitude.
  - b. *Students know* when an object is subject to two or more forces at once, the result is the cumulative effect of all the forces.
  - c. *Students know* when the forces on an object are balanced, the motion of the object does not change.
  - d. *Students know* how to identify separately the two or more forces that are acting on a single static object, including gravity, elastic forces due to tension or compression in matter, and friction.
  - e. *Students know* that when the forces on an object are unbalanced, the object will change its velocity (that is, it will speed up, slow down, or change direction).
  - f. *Students know* the greater the mass of an object, the more force is needed to achieve the same rate of change in motion.
  - g. *Students know* the role of gravity in forming and maintaining the shapes of planets, stars, and the solar system.

## California Standards for Focus on Physical Science *(continued)*

### Structure of Matter

3. **Each of the more than 100 elements of matter has distinct properties and a distinct atomic structure. All forms of matter are composed of one or more of the elements. As a basis for understanding this concept:**
- Students know* the structure of the atom and know it is composed of protons, neutrons, and electrons.
  - Students know* that compounds are formed by combining two or more different elements and that compounds have properties that are different from their constituent elements.
  - Students know* atoms and molecules form solids by building up repeating patterns, such as the crystal structure of NaCl or long-chain polymers.
  - Students know* the states of matter (solid, liquid, gas) depend on molecular motion.
  - Students know* that in solids the atoms are closely locked in position and can only vibrate; in liquids the atoms and molecules are more loosely connected and can collide with and move past one another; and in gases the atoms and molecules are free to move independently, colliding frequently.
  - Students know* how to use the periodic table to identify elements in simple compounds.

### Earth in the Solar System (Earth Sciences)

4. **The structure and composition of the universe can be learned from studying stars and galaxies and their evolution. As a basis for understanding this concept:**
- Students know* galaxies are clusters of billions of stars and may have different shapes.
  - Students know* that the Sun is one of many stars in the Milky Way galaxy and that stars may differ in size, temperature, and color.
  - Students know* how to use astronomical units and light years as measures of distances between the Sun, stars, and Earth.
  - Students know* that stars are the source of light for all bright objects in outer space and that the Moon and planets shine by reflected sunlight, not by their own light.
  - Students know* the appearance, general composition, relative position and size, and motion of objects in the solar system, including planets, planetary satellites, comets, and asteroids.

## California Standards for Focus on Physical Science *(continued)*

### Reactions

5. **Chemical reactions are processes in which atoms are rearranged into different combinations of molecules. As a basis for understanding this concept:**
- Students know* reactant atoms and molecules interact to form products with different chemical properties.
  - Students know* the idea of atoms explains the conservation of matter: In chemical reactions the number of atoms stays the same no matter how they are arranged, so their total mass stays the same.
  - Students know* chemical reactions usually liberate heat or absorb heat.
  - Students know* physical processes include freezing and boiling, in which a material changes form with no chemical reaction.
  - Students know* how to determine whether a solution is acidic, basic, or neutral.

### Chemistry of Living Systems (Life Sciences)

6. **Principles of chemistry underlie the functioning of biological systems. As a basis for understanding this concept:**
- Students know* that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms.
  - Students know* that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur.
  - Students know* that living organisms have many different kinds of molecules, including small ones, such as water and salt, and very large ones, such as carbohydrates, fats, proteins, and DNA.

### Periodic Table

7. **The organization of the periodic table is based on the properties of the elements and reflects the structure of atoms. As a basis for understanding this concept:**
- Students know* how to identify regions corresponding to metals, nonmetals, and inert gases.
  - Students know* each element has a specific number of protons in the nucleus (the atomic number) and each isotope of the element has a different but specific number of neutrons in the nucleus.
  - Students know* substances can be classified by their properties, including their melting temperature, density, hardness, and thermal and electrical conductivity.

## California Standards for Focus on Physical Science *(continued)*

### Density and Buoyancy

8. All objects experience a buoyant force when immersed in a fluid. As a basis for understanding this concept:
- Students know* density is mass per unit volume.
  - Students know* how to calculate the density of substances (regular and irregular solids and liquids) from measurements of mass and volume.
  - Students know* the buoyant force on an object in a fluid is an upward force equal to the weight of the fluid the object has displaced.
  - Students know* how to predict whether an object will float or sink.

### Investigation and Experimentation

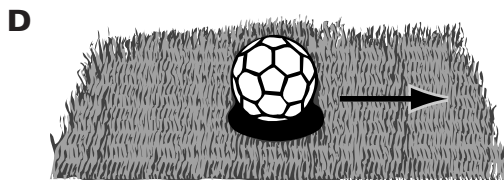
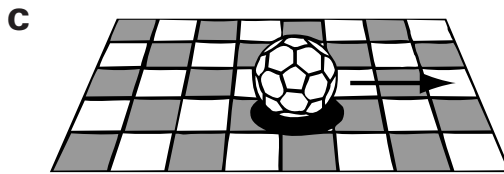
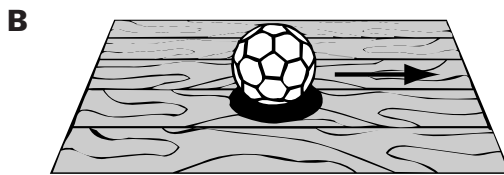
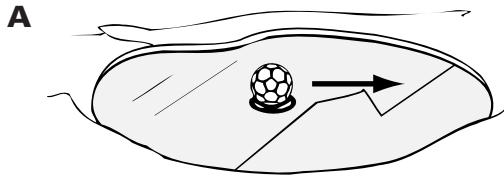
9. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:
- Plan and conduct a scientific investigation to test a hypothesis.
  - Evaluate the accuracy and reproducibility of data.
  - Distinguish between variable and controlled parameters in a test.
  - Recognize the slope of the linear graph as the constant in the relationship  $y=kx$  and apply this principle in interpreting graphs constructed from data.
  - Construct appropriate graphs from data and develop quantitative statements about the relationships between variables.
  - Apply simple mathematic relationships to determine a missing quantity in a mathematic expression, given the two remaining terms (including speed = distance/time, density = mass/volume, force = pressure  $\times$  area, volume = area  $\times$  height).
  - Distinguish between linear and nonlinear relationships on a graph of data.





## Diagnostic Test

- 1** Which picture will require the greatest force to move the ball?



- 2** A runner is training for a race on a straight track. Her trainer records her distance as 1,000 meters after 4 minutes. What is the runner's average speed in meters per second?

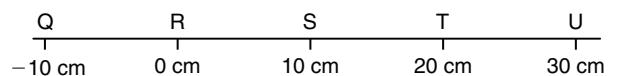
- A** 150 m/s  
**B** 180 m/s  
**C** 193 m/s  
**D** 250 m/s

- 3** The Sun has a whitish-yellow color. Astronomers have found stars similar to the Sun in our galaxy and beyond. If they also have the same color as the Sun, what can scientists conclude about these other stars?

- A** They will have equal densities and temperatures.  
**B** They probably are all identical in size and temperature.  
**C** Color is not useful in studying similar traits between stars.  
**D** They probably have the same surface temperature as the Sun.

- 4** Which of these should be avoided in science?

- A** simplicity  
**B** reproducibility  
**C** accuracy  
**D** bias



- 5** If T is the reference point for measurement, where would the position -10 cm be located?

- A** T  
**B** S  
**C** V  
**D** Q



## Diagnostic Test

- 6** A waxing phase of the Moon is one in which the Moon appears to be \_\_\_\_\_

- A** growing larger.
- B** growing smaller.
- C** eclipsing.
- D** rotating.

Tickets Sold  
to the Science Conference

Group	Number of Tickets Sold
Adult Females	250
Adult Males	200
Student Females	300
Student Males	150
Senior Citizens	100

Total Number of Tickets Sold = 1,000

- 7** Which kind of graph would be the most appropriate to visually compare the number of tickets that each group purchased for the concert?

- A** Bar graph
- B** Line graph
- C** Pie chart
- D** Range graph



- 8** These children are playing tug-of-war, a contest in which each team tugs on a rope to pull the other team across a line.

Everyone is tugging on the rope, but no one is moving because \_\_\_\_\_.

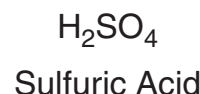
- A** the net force of the two teams is zero
- B** the children do not have enough mass to create force
- C** the rope resists any change in motion
- D** there is too much friction for the rope to move

- 9** An atom of carbon can form a variety of covalent bonds. Which statement about carbon chemistry is most accurate?

- A** Molecules containing carbon have unstable structures.
- B** Molecules containing carbon have a wide range of chemical properties.
- C** Carbon atoms can bond to other carbon atoms, but not with other elements.
- D** Carbon atoms can bond to other elements, but not with other carbon atoms.

- 10** Which statement best describes the difference between speed and velocity?

- A** Speed is distance divided by time, and velocity is total distance.
- B** Speed is how fast an object is moving, and velocity includes speed and direction.
- C** Velocity is how fast an object is moving, and speed includes speed and direction.
- D** Speed and velocity are in units of meters per second.



- 11** According to the chemical formula in the box above, all of the following chemical elements can be found in a molecule of sulfuric acid EXCEPT \_\_\_\_\_.

- A** carbon
- B** hydrogen
- C** oxygen
- D** sulfur



## Diagnostic Test

- 12** All of the following are important organic compounds used by the body EXCEPT \_\_\_\_\_.

- A** carbohydrates
- B** lipids
- C** proteins
- D** binary salts

### Characteristics of Some Solids

Solid	Atomic Number	Atomic Mass
Sodium	11	22.99
Potassium	19	39.10
Carbon	6	12.01
Sulfur	16	32.07

- 13** According to this information, which solid has fewer than 10 protons in its nucleus?

- A** sodium
- B** potassium
- C** carbon
- D** sulfur

- 14** Nitrogen-fixing bacteria transform nitrogen from the air into molecules that are useful to living organisms. Which compound found in organisms, contains nitrogen?

- A** salt
- B** water
- C** amino acids
- D** carbon dioxide

- 15** Kyle notices a train passing by. He is curious to know how fast the train is traveling so he notes several positions and times of the engine as shown in the table below.

Train Position	
Time (minutes)	Position (meters)
0.0	0
0.5	200
1.0	400
1.5	600
2.0	800

How fast is the train traveling in meters per minute?

- A** 200
- B** 400
- C** 800
- D** 1600

### Elements

Element	Number of Protons	Number of Neutrons
Hydrogen	1	0
Carbon	6	6
Oxygen	8	8
Uranium	92	142

- 16** The mass number of an atom is equal to the number of protons and neutrons in its nucleus. According to this definition, which of the elements in the table has the highest mass number?

- A** hydrogen
- B** carbon
- C** oxygen
- D** uranium



## Diagnostic Test

**17** Stefan is floating on his back in a swimming pool. The weight of the water he displaces

- A** is more than his weight.
- B** is less than his weight.
- C** is equal to his weight.
- D** cannot be determined.

**18** Which of the following statements describes the results of gravitational force on a planet in our solar system?

- A** The planet has a tilted rotational axis.
- B** The planet rotates at a constant speed.
- C** The planet follows a curved path around the Sun.
- D** The temperature on the surface of the planet is nearly constant.

**19** An educated guess about the probable outcome of an experiment is called a

- A** hypothesis.
- B** control.
- C** variable.
- D** constant.

**Electric Train's Movement**

Kilowatts	Kilometers/Hour
10	7.2
20	14.4
30	21.6
40	?

**20** According to the conductor of an electric train, every 10 kilowatts of electricity can move a train 7.2 kilometers per hour. According to this information, how fast will an electric train move with 40 kilowatts?

- A** 14.4 km/h
- B** 21.2 km/h
- C** 28.8 km/h
- D** 35.6 km/h

**Bay School Runners**

Name	Distance	Time
David	200 meters	20 seconds
Jolene	100 meters	10 seconds
Pooja	300 meters	20 seconds
Henry	100 meters	20 seconds

**21** According to this information, which runner had a speed of 15 m/s?

- A** David
- B** Henry
- C** Jolene
- D** Pooja

**22** Sometimes two elements combine to make a new substance with its own special properties. This new substance is an example of

- A** a homogeneous mixture
- B** a heterogeneous mixture
- C** an atom
- D** a compound

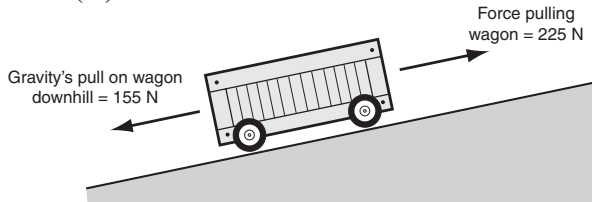


## Diagnostic Test

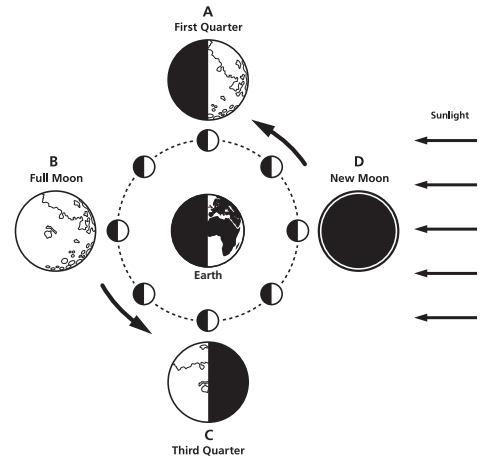
**23** Miranda performed an experiment to determine what makes an object sink or float in water. She experimented with 10 different items and recorded the results. Which of the following will her data show?

- A** The object's shape is the only determining factor.
- B** The size of the object determines if it will sink or float.
- C** The mass and volume of an object determine if it will sink or float.
- D** Light-colored objects tend to float more easily than darker-colored objects.

**24** Various forces act on the wagon as shown in the figure below. What is the net force acting on the wagon in newtons (N)?



- A** 45 N uphill
- B** 70 N uphill
- C** 45 N downhill
- D** 70 N downhill



**25** In the diagram above, in which phase of the Moon could a total lunar eclipse occur?

- A** A
- B** B
- C** C
- D** D

**Friction/Machine Efficiency Relationship**

Trial	Amount of Friction Applied	Efficiency of Machine (%)
1	none	100
2	low	85
3	medium	70
4	high	55

**26** The table above shows the relationship between a machine's efficiency and the effects of friction. A reasonable hypothesis based on these data is that if the amount of friction applied increases, then \_\_\_\_\_.

- A** the machine's efficiency will increase
- B** the machine will become completely inefficient
- C** the work completed by the machine will increase
- D** the machine's efficiency will decrease

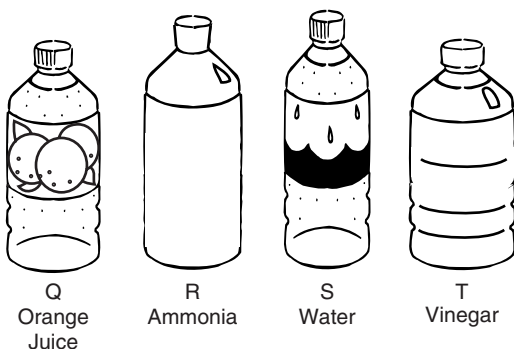


## Diagnostic Test



Magnesium plus oxygen produces magnesium oxide

- 27** 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.



- 28** The picture shows four liquids in bottles. Each liquid will be tested to determine its pH measurement. When they are tested, which liquid should have a pH closest to 14?
- A** Q
  - B** R
  - C** S
  - D** T

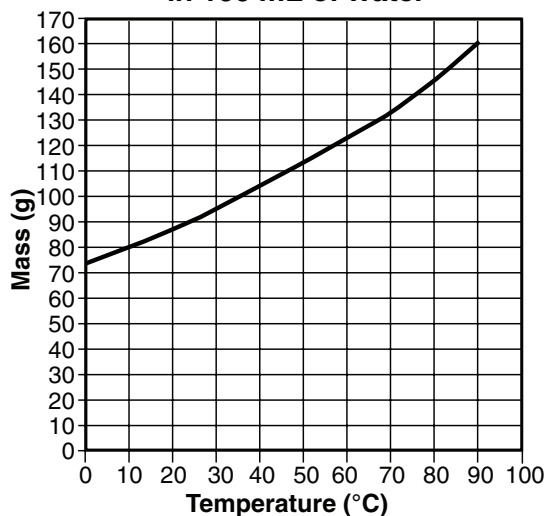


- 29** This picture shows a girl holding a ball. According to this picture, what is exerting a force on the ball?
- A** only rolling friction
  - B** only magnetism
  - C** the girl and gravity
  - D** only gravity
- 30** Earth is approximately 149 million km from the Sun. Mercury is approximately 58 million km from the Sun. Which value is the BEST estimate of the distance from the Sun to mercury in AU?
- A** 0.4 AU
  - B** 1.0 AU
  - C** 1.5 AU
  - D** 2.3 AU
- 31** Which of these is NOT evidence of a chemical reaction?
- A** An iron nail changes to a brownish-orange color.
  - B** An ice cube melts into liquid water.
  - C** An antacid tablet produces bubbles of gas when placed in water.
  - D** A piece of zinc raises the temperature of an acid as it reacts with it.



## Diagnostic Test

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



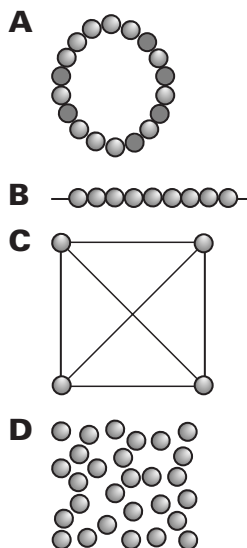
**32** Based on the graph above, what is the relationship between temperature and mass of sodium nitrate that can be dissolved in water?

- A** constant
- B** linear
- C** decreasing
- D** nonlinear

**33** What is the approximate number of grams of sodium nitrate that can be dissolved in water at a temperature of 70°C?

- A** 125 g
- B** 130 g
- C** 135 g
- D** 140 g

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



**35** Which of the following is *not* a metal?

- A** iron
- B** calcium
- C** sulfur
- D** nickel

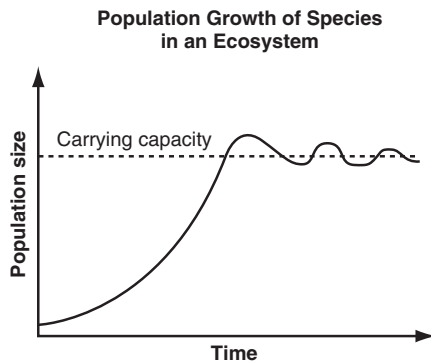
**36** Experimental results are compared against the results of controls. Controls improve an experiment by

- A** ensuring that the experiment tests only one variable.
- B** allowing for the experiment to test as many variables as possible.
- C** making sure everything in the experiment remains constant.
- D** guaranteeing that the experimental outcome verifies the hypothesis.



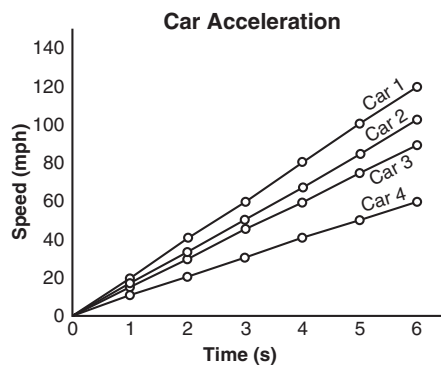
## Diagnostic Test

Use the graph below to answer question?



- 37** What does the line graph above show?
- A** Populations increase at a constant rate in ecosystems.
  - B** Populations usually increase rapidly and then level off.
  - C** Populations increase at an exponential rate.
  - D** Ecosystems are able to support any number of populations.

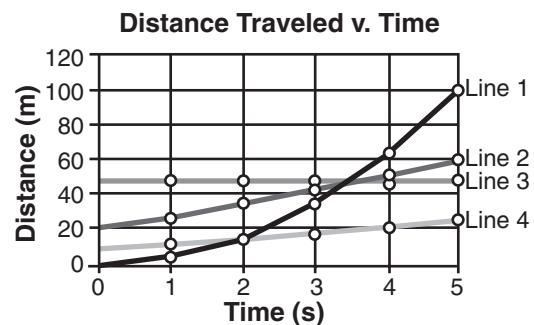
- 38** This graph represents the change in velocity of four cars over a period of 6 s. Which line represents the car that traveled the greatest distance?



- A** Line1
- B** Line2
- C** Line3
- D** Line4

- 39** Carbon atoms that are found in living organisms most commonly bond to atoms of hydrogen, oxygen, and

- A** calcium.
- B** magnesium.
- C** nitrogen.
- D** sodium.



- 40** Which line on the graph represents an object that has an unbalanced force acting on it?

- A** Line1
- B** Line2
- C** Line3
- D** Line4

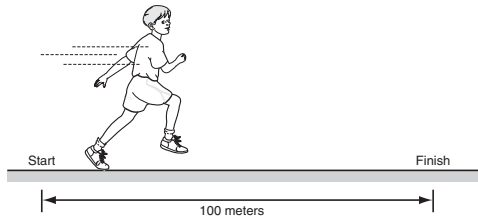
- 41** If an unknown object has a mass of 39 g and a density of 3 g/mL, what is its volume in milliliters?

- A** 3 mL
- B** 13 mL
- C** 31 mL
- D** 39 mL



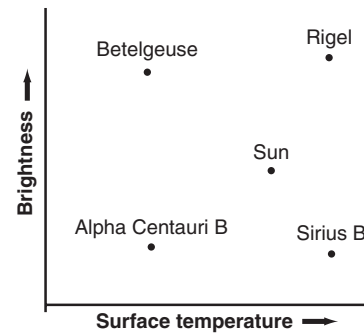
## Diagnostic Test

- 42** The diagram below shows a runner and the course he runs. He completes the course in 10 seconds. What is his average speed in meters per second?



- A** 100 m/s  
**B** 10 m/s  
**C** 1 m/s  
**D** 50 m/s
- 43** Molecules in a gas are in constant motion and are spread very far apart. Which description fits the molecular arrangement and motion of a solid?
- A** tightly packed molecules that do not move  
**B** loosely packed molecules that move randomly  
**C** tightly packed molecules that compress over time  
**D** tightly packed molecules that vibrate in fixed areas

- 44** The diagram below is a modified Hertzsprung-Russell diagram. Describe the characteristics of the star Rigel.



- A** bright, cool  
**B** bright, hot  
**C** dim, cool  
**D** dim, hot
- 45** An ionic bond forms between a metal and a nonmetal. According to this information, which of the following pairs of elements could form an ionic bond?
- A** two atoms of hydrogen  
**B** an atom of carbon and an atom of oxygen  
**C** an atom of magnesium and an atom of oxygen  
**D** an atom of lithium and an atom of calcium
- 46** In a chemical reaction, 90 g  $\text{H}_2\text{O}$  reacts to produce 80 g  $\text{O}_2$  and a certain amount of  $\text{H}_2$ . 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 ( $\text{H}_2$ ) was produced in this reaction?
- A** 2g  
**B** 10g  
**C** 0.5g  
**D** 90 g

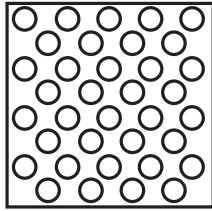


## Diagnostic Test

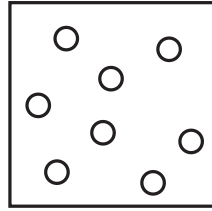
- 47** Which is a true statement about compounds?
- A** Compounds cannot be broken down into simpler substances.
  - B** Compounds can only be made of nonmetals or inert gases.
  - C** Compounds are listed on the periodic table.
  - D** Compounds have different properties than the elements that compose them.
- 48** A student fills a sandwich bag with hot water, seals it, and puts it in a large container of room temperature water. Which will happen?
- A** The bag will burst.
  - B** The bag will dissolve.
  - C** The bag will float.
  - D** The bag will sink.
- 49** Caleb performs an experiment with a ball. He tosses the ball horizontally and observes that it curves down and hits the floor. He repeats the trial several times with different balls but gets the same result every time. Which conclusion could Caleb draw from his experiment?
- A** An object can never move at a constant velocity.
  - B** The mass of the balls determines how they are affected by gravity.
  - C** The balls are being subjected to a net force.
  - D** The balls are not being subjected to a net force.
- 50** NaCl is an example of a(n)
- A** atom.
  - B** element.
  - C** compound.
  - D** isotope.
- 51** Which of the following is not a subatomic particle?
- A** electron
  - B** neutron
  - C** nucleus
  - D** proton
- 52** A car is traveling 65 km/h north on Highway 101. The highway turns to the right. If the car maintains its current speed, which is true?
- A** The average speed will decrease.
  - B** The average speed will increase.
  - C** The velocity will change.
  - D** The velocity will remain constant.
- 53** Which of the following describes a galaxy?
- A** planets that orbit a single star
  - B** stars, gas, and dust held together by gravity
  - C** a single ball of gas that gives off light and heat
  - D** ice or frozen gas that is clumped together and orbits the Sun
- 54** Jeff was trying to determine if his experiment had undergone a physical or chemical change. Which observation could mean that it was NOT a chemical change?
- A** Something was burning.
  - B** Bubbles of a new gas formed.
  - C** The temperature changed.
  - D** The colors of the reactants changed.



## Diagnostic Test



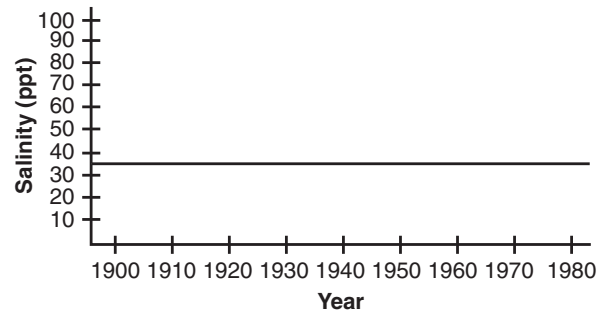
0°C



120°C

- 55** According to the diagram above, which statement best describes what happens to water molecules when they are heated?
- A** They move further apart.
  - B** They move at a slower speed.
  - C** They bond with each other.
  - D** Their energy level decreases.
- 56** The orbits of the planets in the solar system is determined by the gravitational attraction between them which depends on
- A** the masses of the objects and the distance between them.
  - B** the distance between the objects only.
  - C** the densities of the objects only.
  - D** the weight of the objects only.

Ocean Salinity



- 57** The graph above shows the average salinity over an 80-year period. A reasonable conclusion based on these data is that over the past 80 years,
- A** the average ocean salinity has increased.
  - B** the average ocean salinity has remained constant.
  - C** the average ocean salinity has decreased.
  - D** the average ocean salinity has remained in a state of unbalance.
- 58** Which of the following would be the best for conducting electricity?
- A** copper
  - B** oxygen
  - C** wood
  - D** paper
- 59** Information about chemical reactions that release energy most likely would be found under which category in a textbook?
- A** endothermic
  - B** exothermic
  - C** electrolysis
  - D** activation energy



## Diagnostic Test

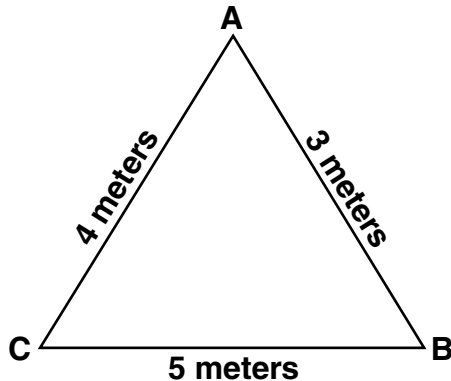
- 60** A bottle of water sits on a table. The force of the bottle on the table is 70 N and the table does not move. Which of the following statements is accurate?
- A** The the force of the table on the bottle is 70 N.
  - B** The force of the table on the bottle is greater than 70 N.
  - C** The force of the table on the bottle is less than 70 N.
  - D** The table does not put a force on the bottle.
- 61** Brynne is walking two dogs, a large one and a small one. When the small dog tries to run, Brynne easily stops it, but when the large dog tries, she has difficulty. This demonstrates that
- A** an object in motion tends to stay in motion.
  - B** acceleration equals mass divided by force.
  - C** every action has an equal and opposite reaction.
  - D** force equals mass times acceleration.
- 62** At room temperature nitrogen is a gas, but if it is cooled, it becomes a liquid at  $-320^{\circ}\text{C}$ . Which is accurate?
- A** Nitrogen boils at  $-320^{\circ}\text{C}$
  - B** Nitrogen freezes at  $-320^{\circ}\text{C}$
  - C** Nitrogen is hot when it is  $-320^{\circ}\text{C}$
  - D** Molecules move faster at  $-320^{\circ}\text{C}$
- 63** If it were night time and you wanted to find out if the Sun was having a flare, you would most likely
- A** look to see if the stars get dimmer.
  - B** look to see if the stars get brighter.
  - C** look to see if the Moon gets dimmer.
  - D** look to see if the Moon gets brighter.
- 64** If two objects have the same volume but different mass, then they must
- A** have different density.
  - B** have different size.
  - C** be different chemicals.
  - D** weigh the same.
- 65** When can the slope of a graph represent density?
- A** when volume is the x value and temperature is the y value
  - B** when mass is the y value and volume is the x value
  - C** when density is the y value and weight is the x value
  - D** when temperature is the x value and density is the y value



## Standards Practice: Motion

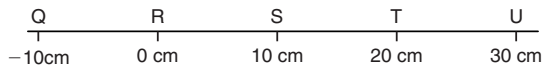
The velocity of an object is the rate of change of its position. As a basis for understanding this concept:

**1.a.** Students know position is defined in relation to some choice of a standard reference point and a set of reference directions.



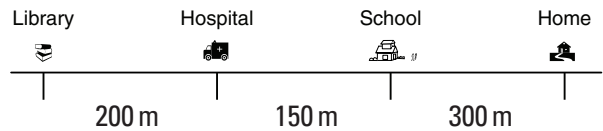
**1** Jason walks from Point A to Point B. Then he walks to Point C and finally back to Point A. According to this information, which of the following represents Jason's displacement from Point A?

- A** 12 m
- B** 9 m
- C** 0 m
- D** 7 m



**2** If T is the reference point for measurement, where would the position  $-10$  cm be located?

- A** T
- B** S
- C** V
- D** Q



**3** If school is the reference point, how would you describe the position of the library in relation to the school?

- A**  $-200$  m
- B** 400 m
- C** 200 m
- D**  $-100$  m

**1.b.** Students know that average speed is the total distance traveled divided by the total time elapsed and that the speed of an object along the path traveled can vary.

**4** Which is measured in meters per second (m/s)?

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

**5** What three variables are needed to calculate average speed?

- A** rate, distance, and time
- B** rate, direction, and time
- C** rate, distance, and speed
- D** rate, distance, and velocity



## Standards Practice: Motion

**1.c.** Students know how to solve problems involving distance, time, and average speed.

- 6** Light travels at an approximate speed of 300,000 kilometers per second. Jupiter is located 779,000,000 kilometers from the Sun. How many minutes does it take for light to travel from the Sun to Jupiter? Round your answer to the nearest minute.
- A** 43 min
  - B** 2,597 min
  - C** 44 min
  - D** 2,596 min

**1.d.** Students know the velocity of an object must be described by specifying both the direction and the speed of the object.

- 7** 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** time
  - D** direction
- 8** Marisol wants to know the velocity of a toy car rolling down a ramp. Which measurements will give her enough information to determine velocity?
- A** height of the ramp and mass of the car
  - B** speed of the car and surface friction of the ramp
  - C** length of the ramp and size of the wheels
  - D** speed of the car and direction of motion

**1.e.** Students know changes in velocity may be due to changes in speed, direction, or both.

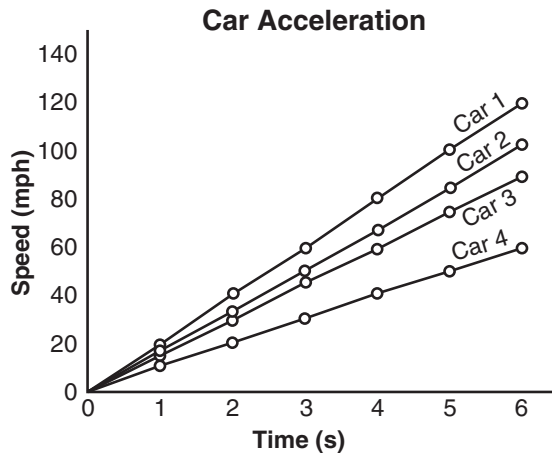
- 9** Kim's father presses the gas pedal in his car and speeds up from 10 meters per second (m/s) to 35 m/s in 5 seconds. What is the car's change in velocity?
- A** 50 m/s
  - B** 45 m/s
  - C** 30 m/s
  - D** 25 m/s
- 10** A car is traveling 65 km/h north on Highway 101. The highway turns to the right. If the car maintains its current speed, which is true?
- A** The average speed will decrease.
  - B** The average speed will increase.
  - C** The velocity will change.
  - D** The velocity will remain constant.
- 11** A runner is sprinting around a track. She slows down going around a curve. Which statement best describes her motion?
- A** Her speed changes, but her velocity is constant.
  - B** Both her speed and her velocity are unchanged.
  - C** Both her speed and her velocity change.
  - D** Her velocity changes, but her speed is constant.



## Standards Practice: Motion

**1.f.** Students know how to interpret graphs of position versus time and graphs of speed versus time for motion in a single direction.

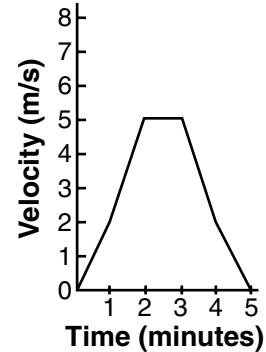
**12** The graph represents the change in speed in four cars.



The steepness of the line shows how fast the cars are accelerating. On the x-axis, the scale of unit time is given by  $1 \text{ s} = 1 \text{ cm}$ . Suppose the unit scale is changed so  $1 \text{ s} = 0.5 \text{ cm}$ . How would this change affect the acceleration of the cars?

- A** The acceleration of the cars would double.
- B** The acceleration of the cars would be reduced by half.
- C** The acceleration of the cars would not change.
- D** The acceleration of the cars would increase by half.

**13** This graph shows Emilio's speed as he walked to school.



What is the time interval on the graph when Emilio is not accelerating?

- A** from 0 min. to 2 min.
- B** from 2 min. to 3 min.
- C** from 4 min. to 5 min.
- D** from 1 min. to 5 min.



## Standards Practice: Forces

Unbalanced forces cause changes in velocity. As a basis for understanding this concept:

**2.a.** Students know a force has both direction and magnitude.

**14** Which most thoroughly describes a force?

- A** A car experiences a 30 N push from a large truck.
- B** A rubber band pulls on a 3.2 g mass, causing it to change direction.
- C** A car applies the brakes and comes to a complete stop.
- D** A steel beam experiences a 4,000 N downward gravitational pull.

**15** Nyla hits the cue ball with a pool stick. What information is needed to accurately describe the force of the pool stick on the cue ball?

- A** the mass of the pool stick and the magnitude of the force
- B** the direction of the force and the mass of the ball
- C** the mass of the ball and the mass of the pool stick
- D** the direction of the force and the magnitude of the force

**16** A force is best described by

- A** distance and time.
- B** direction and magnitude.
- C** mass and volume.
- D** speed and velocity.

**2.b.** Students know when an object is subject to two or more forces at once, the result is the cumulative effect of all the forces.

**17** An airplane is accelerating forward due to a force of 3320 newtons acting on it. Then it encounters wind resistance that exerts a backward force of 550 newtons. What is the net force, in newtons, acting on the airplane?

- A** 3,870 N forward
- B** 3,270 N backward
- C** 0 N
- D** 2,770 N forward

**2.c.** Students know when the forces on an object are balanced, the motion of the object does not change.

**18** A train moves forward at a constant speed. What is true about the forces acting on the train?

- A** The forward forces are equal to the forces acting in the backward direction.
- B** The forward forces are greater than the forces acting in the backward direction.
- C** The forward forces are smaller than the forces acting in the backward direction.
- D** There can never be any force acting on the train when it moves at a constant speed.



## Standards Practice: Forces

**2.d.** Students know how to identify separately the two or more forces that are acting on a single static object, including gravity, elastic forces due to tension or compression in matter, and friction.

**19** Solange notices that a soccer player is holding a soccer ball with his hands on each side of the ball. He notices that the ball remains in a stationary position. What two forces are acting on the ball to keep it in a stationary position?

- A** magnetism and friction
- B** elastic and tension
- C** gravity and friction
- D** magnetism and gravity

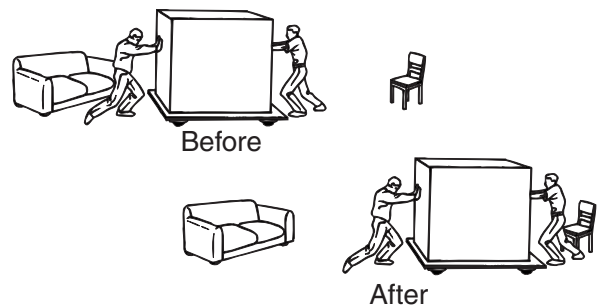
**20** A flower pot is suspended from a beam by a rope in a fixed position. Which forces are acting on the flower pot?

- A** gravity and friction
- B** compression and magnetism
- C** gravity and motion
- D** gravity and tension

**2.e.** Students know that when the forces on an object are unbalanced, the object will change its velocity (that is, it will speed up, slow down, or change direction).

**21** Caleb performs an experiment with a ball. He tosses the ball horizontally and observes that it curves down and hits the floor. He repeats the trial several times with different balls but gets the same result every time. Which conclusion could Caleb draw from his experiment?

- A** An object can never move at a constant velocity.
- B** The mass of the balls determines how they are affected by gravity.
- C** The balls are being subjected to an unbalanced force.
- D** The balls are being subjected to a balanced force.



**22** The pictures show a large box being pushed in opposite directions by two men. The box changed its position in the room because \_\_\_\_\_.

- A** the opposing forces were balanced
- B** the smooth floor created no friction
- C** the man on the left side applied more force than the man on the right side
- D** the man on the right side applied more force than the man on the left side



## Standards Practice: Forces

**2.f.** Students know the greater the mass of an object, the more force is needed to achieve the same rate of change in motion.

- 23** Jamal, a professional bicycle racer, is explaining to a group of students how technology has made it easier to cycle faster. He states that bicycles can be made of much lighter materials now, so they need
- A** more force to push them forward
  - B** less force to push them forward
  - C** more friction to keep them from rolling
  - D** more gravity to increase their speed
- 24** A 500 kg motorcycle and 4,000 kg motor home are traveling at 30 m/s on the same freeway. Which would require the least force to come to a complete stop?
- A** the motor home
  - B** They require the same force.
  - C** It depends upon the slope of the freeway.
  - D** the motorcycle
- 25** Oliver has a set of toy cars. Which car would require the greatest force to accelerate from a static position to a velocity of 12 m/s on a horizontal surface?
- A** a 4-g car
  - B** a 1-g car
  - C** a 12-g car
  - D** a 25-g car

**2.g.** Students know the role of gravity in forming and maintaining the shapes of planets, stars, and the solar system.

- 26** The Moon is kept in orbit by which force?
- A** friction
  - B** electromagnetic
  - C** gravity
  - D** elastic
- 27** What phenomenon is responsible for maintaining the planets' orbits around the sun?
- A** the Sun's radiation
  - B** gravity
  - C** magnetism
  - D** electricity
- 28** The path of a comet is curved due to the gravitational pull of the sun. Which statement below best explains why the Sun does not appear to move as a result of the comet's gravitational pull?
- A** The Sun's mass is far greater than the comet's mass.
  - B** The comet's path decreases the Sun's gravity.
  - C** The comet is too far away to exert a force on the Sun.
  - D** Only the Sun exerts a gravitational pull.



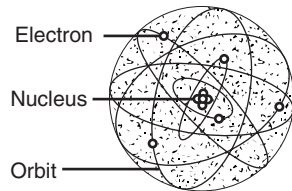
## Standards Practice: Structure of Matter

Each of the more than 100 elements of matter has distinct properties and a distinct atomic structure. All forms of matter are composed of one or more of the elements. As a basis for understanding this concept:

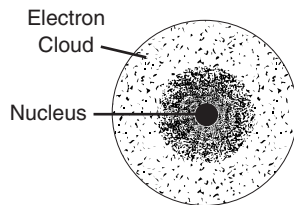
**3.a. Students know the structure of the atom and know it is composed of protons, neutrons, and electrons.**

**29** Which of the diagrams below represents the modern model of the atom?

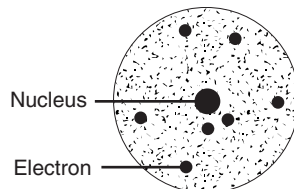
**A**



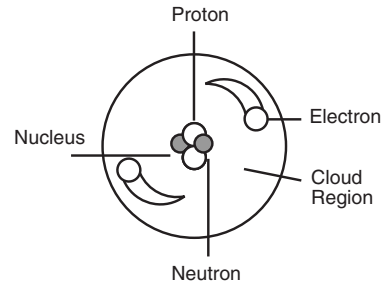
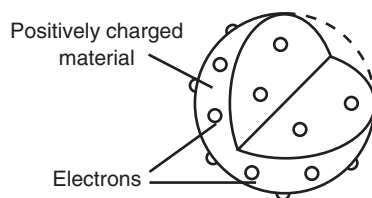
**B**



**C**



**D**



**30** Which particle is located in the cloud region of the atom above?

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

**31** Most atoms contain one or more positively charged particles in their nuclei. These positively charged particles are called

- A** neutrons
- B** electrons
- C** protons
- D** compounds

**32** Which statement best describes subatomic particles?

- A** Neutrons are in the nucleus, and protons have a negative charge.
- B** Protons have a positive charge, and electrons orbit the nucleus.
- C** Electrons have a negative charge, and neutrons orbit the nucleus.
- D** Electrons are in the nucleus, and protons have no charge.



## Standards Practice: Structure of Matter

**3.b.** Students know that compounds are formed by combining two or more different elements and that compounds have properties that are different from their constituent elements.

**33** A compound is a substance that contains two or more elements. According to this definition, which of these formulas represents a compound?

- A Li
- B Br<sub>2</sub>
- C NaCl
- D 3O<sub>2</sub>

**34** Salt, an edible white crystal, is made of sodium, which is a soft metal, and chlorine, which is a poisonous gas. This example of a compound shows that

- A compounds have different properties than the elements they are made of.
- B chlorine isn't really poisonous.
- C elements keep their individual properties even when combined with other elements.
- D compounds are not made of elements.

**3.c.** Students know atoms and molecules form solids by building up repeating patterns, such as the crystal structure of NaCl or long-chain polymers.

**35** 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.

**36** Which is a true statement about solids?

- A Salt is a crystalline solid, and rubber is an amorphous solid.
- B Salt is made of long chains of molecules, and rubber has a crystal structure.
- C Salt is an amorphous solid, and rubber has molecules arranged in a repeating pattern.
- D Salt and rubber are both crystalline solids.

**37** Which state of matter is composed of atoms arranged in regular and repeating patterns?

- A a gas
- B a plasma
- C a liquid
- D a solid

**3.d.** Students know the states of matter (solid, liquid, gas) depend on molecular motion.

**38** A piece of chocolate is left in a hot car. What process causes it to become soft?

- A condensation
- B vaporization
- C freezing
- D melting

**39** Which of these is *not* a state of matter?

- A solid
- B liquid
- C substance
- D gas



## Standards Practice: Structure of Matter

**40** Which of the following objects has the slowest moving molecules?

- A** fresh snow
- B** warm bread
- C** a melted ice cube
- D** a hot cup of coffee

**3.e.** Students know that in solids the atoms are closely locked in position and can only vibrate; in liquids the atoms and molecules are more loosely connected and can collide with and move past one another; and in gases the atoms and molecules are free to move independently, colliding frequently.

**41** In the picture below, a pot of water is being boiled. Which of the following describes what is happening to the water molecules just above the surface line of the water?



- A** The molecules are breaking down into atoms.
- B** The molecules are farther apart than those below.
- C** The molecules are moving slower and closer together.
- D** The molecules have stopped moving by the time the water boils.

**3.f.** Students know how to use the periodic table to identify elements in simple compounds.

**42** Which compound contains potassium?

- A**  $\text{PO}_4$
- B**  $\text{NaOH}$
- C**  $\text{KCl}$
- D**  $\text{PtF}_4$

**43** The compound  $\text{NaOH}$  contains

- A** helium.
- B** sulfur.
- C** argon.
- D** sodium.

**44** The compound  $\text{C}_0\text{H}_{12}\text{O}_6$  contains how many hydrogen atoms?

- A** 6
- B** 2
- C** 0
- D** 12



## Standards Practice: Earth in the Solar System (Earth Sciences)

The structure and composition of the universe can be learned from studying stars and galaxies and their evolution. As a basis for understanding this concept:

**4.a.** Students know galaxies are clusters of billions of stars and may have different shapes.

**45** There are three main types of galaxies: spiral, elliptical, and irregular. All galaxies, regardless of type, contain which of the following?

- A** stars
- B** liquid water
- C** long, spiral arms
- D** a well-defined core

**46** Which term is best described as a large number of stars, gas, and dust held together by gravity?

- A** galaxy
- B** universe
- C** solar system
- D** planetary system

**4.b.** Students know that the Sun is one of many stars in the Milky Way galaxy and that stars may differ in size, temperature, and color.

**47** The largest stars may become all of the following EXCEPT

- A** a neutron star
- B** a white dwarf
- C** a supernova
- D** a black hole

**4.c.** Students know how to use astronomical units and light years as measures of distances between the Sun, stars, and Earth.

**48** A light-year is a unit of distance that measures how far light can travel in one year. One light-year is equal to 9,500,000,000,000 kilometers. Why do scientists use light-years to measure distances in the universe?

- A** Light-years determine the ages of planets and stars.
- B** Light-years are more accurate than other measurements.
- C** Light-years tell us about the brightness and distance of other objects.
- D** Other units of distance, such as kilometers, are too small to be useful.

**49** Earth is 1 astronomical unit (AU) from the Sun. Jupiter is approximately 5 AU from the Sun. If it takes sunlight 8.3 min to reach Earth, how long does it take to reach Jupiter?

- A** 1.6 min
- B** 3.3 min
- C** 13.3 min
- D** 41.5 min

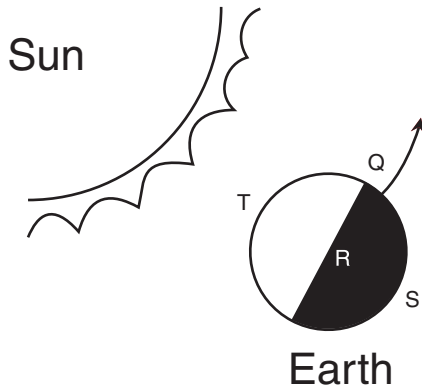
**50** Which would be most useful for measuring distance between stars?

- A** light-years
- B** light-minutes
- C** astronomical units
- D** kilometers



## Standards Practice: Earth in the Solar System (Earth Sciences)

**4.d.** Students know that stars are the source of light for all bright objects in outer space and that the Moon and planets shine by reflected sunlight, not by their own light.



**51** In the picture of Earth in space, it is most likely sunrise at \_\_\_\_\_.

- A** Q
- B** R
- C** S
- D** T

**52** What causes a solar eclipse?

- A** Earth rotates around its axis at exactly the same rate that it revolves around the Moon, casting a shadow that momentarily blocks out sunlight.
- B** Earth passes between the Sun and the Moon, casting a shadow that momentarily blocks out moonlight.
- C** The Moon passes between Earth and the Sun, momentarily blocking out sunlight.
- D** The Sun passes between Earth and the Moon, momentarily blocking out sunlight.

**53** Which object shines by reflecting light?

- A** the Sun
- B** a red star
- C** the Moon
- D** a white dwarf star

**4.e.** Students know the appearance, general composition, relative position and size, and motion of objects in the solar system, including planets, planetary satellites, comets, and asteroids.

**54** Which would most likely indicate that Mercury has no atmosphere?

- A** It has a large iron core and magnetic field.
- B** There is no vegetation on its surface.
- C** It has a low gravitational pull.
- D** It has thin outer surface layers.

**55** Photographs of Io, a moon of Jupiter, have shown that this body has high volcanic activity. The cause of this activity is most likely

- A** a large iron core.
- B** vast water oceans underneath an ice-rock crust.
- C** its small size.
- D** the gravitational pulls from both Jupiter and another Jupiter moon.



## Standards Practice: Reactions

Chemical reactions are processes in which atoms are rearranged into different combinations of molecules. As a basis for understanding this concept:

**5.a.** Students know reactant atoms and molecules interact to form products with different chemical properties.

**56** Which would indicate that a chemical reaction has taken place?

- A** The new substance has different properties from the original substance.
- B** The new substance has twice the volume of the original substance.
- C** The original substance has a heavier mass and the new substance has a lighter mass.
- D** The original substance evaporated from a liquid into a gas.

**5.b.** Students know the idea of atoms explains the conservation of matter: In chemical reactions the number of atoms stays the same no matter how they are arranged, so their total mass stays the same.

**57** Maya learned that a chemical reaction yields the products  $\text{CO}_2 + 2\text{H}_2\text{O}$ . Her teacher asked how many atoms of oxygen were in the reactants. Which is her answer?

- A** 2
- B** 3
- C** 4
- D** 6

**5.c.** Students know chemical reactions usually liberate heat or absorb heat.

**58** Which of these would you expect to have a significant effect on the rate of a chemical reaction?

- A** the shape of the container
- B** the time of day
- C** a change in temperature
- D** the type of equipment used

**59** Theresa was observing a chemical reaction and concluded it was endothermic. What observation probably led Theresa to this conclusion?

- A** The final products were colder than the reactants.
- B** The final products were warmer than the reactants.
- C** The chemical reaction had occurred quickly.
- D** The chemical reaction had occurred slowly.

**60** During his science lab, Lucas found out that the reaction between water and sodium hydroxide releases heat. Which best describes this reaction?

- A** synthesis
- B** exothermic
- C** endothermic
- D** decomposition

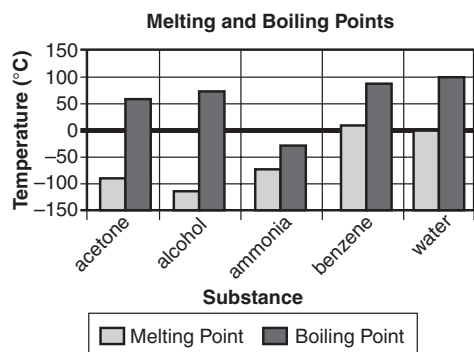
**5.d.** Students know physical processes include freezing and boiling, in which a material changes form with no chemical reaction.

**61** Which of the following would *not* be considered a chemical reaction?

- A** a metal rusts
- B** a magazine is torn
- C** food is digested
- D** firewood is burned



## Standards Practice: Reactions



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

- A acetone
- B alcohol
- C ammonia
- D benzene

**63** Caitlyn correctly wrote a statement on the board describing physical processes. Which statement is hers?

- A Melting and burning: Matter doesn't change form and there is NO chemical reaction.
- B Rusting and freezing: Matter changes form and there IS a chemical reaction.
- C Freezing and boiling: Materials change form and there is NO chemical reaction.
- D Freezing and boiling: Materials change form and there IS a chemical reaction.

**5.e.** Students know how to determine whether a solution is acidic, basic, or neutral.

**64** Which of these pairs of liquids is most likely to chemically neutralize each other when mixed?

- A Orange juice and lemonade
- B Ammonia and water
- C Orange juice and oven cleaner
- D Vinegar and lemonade

### pH of Acidic Solutions

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

**65** 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



**66** The equations above show two bases reacting with water. Which of these is the major characteristic of bases?

- A They form OH<sup>-</sup> ions in solution.
- B They contain many sodium atoms.
- C They are gases.
- D They release protons.



## Standards Practice: Chemistry of Living Systems (Life Sciences)

Principles of chemistry underlie the functioning of biological systems. As a basis for understanding this concept:

**6.a.** Students know that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms.

**67** Which compound found in living organisms contains carbon?

- A** water
- B** salt
- C** glucose
- D** oxygen

**68** An atom of carbon can form a variety of covalent bonds. Which statement about carbon chemistry is most accurate?

- A** Molecules containing carbon have unstable structures
- B** Molecules containing carbon have a wide range of chemical properties.
- C** Carbon atoms can bond to other carbon atoms, but not with other elements.
- D** Carbon atoms can bond to other elements, but not with other carbon atoms.

**6.b.** Students know that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur.

**69** More than 96 percent of your body is made of which four elements?

- A** carbon, hydrogen, oxygen, and nitrogen
- B** carbon, hydrogen, sulfur, and iodine
- C** carbon, hydrogen, helium, and iron
- D** carbon, hydrogen, gold, and mercury

**6.c.** Students know that living organisms have many different kinds of molecules, including small ones, such as water and salt, and very large ones, such as carbohydrates, fats, proteins, and DNA.

**70** Living organisms consist of molecules of many different kinds and sizes. When studying what living things are made of, biologists would not find

- A** neon.
- B** DNA.
- C** fat.
- D** protein.

**71** Which molecule is found in all living organisms?

- A** ozone
- B** aluminum
- C** nylon
- D** carbohydrate



## Standards Practice: Periodic Table

The organization of the periodic table is based on the properties of the elements and reflects the structure of atoms. As a basis for understanding this concept:

**7.a.** Students know how to identify regions corresponding to metals, nonmetals, and inert gases.

**72** Most of the elements on the Periodic Table are

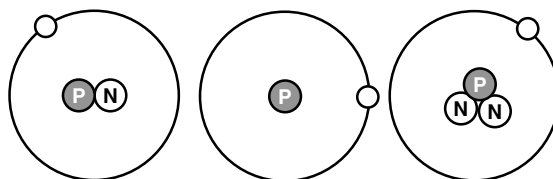
- A** metals.
- B** nonmetals.
- C** inert gases.
- D** semimetals.

**7.b.** Students know each element has a specific number of protons in the nucleus (the atomic number) and each isotope of the element has a different but specific number of neutrons in the nucleus.

**73** 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 \_\_\_\_\_.

- A** radioactive
- B** isotopes
- C** nuclei
- D** tracers

Isotopes of Hydrogen



**74** Which of these statements is correct?

- A** All isotopes of hydrogen have one proton in the nucleus.
- B** All isotopes of hydrogen have one neutron in the nucleus.
- C** Isotopes of hydrogen have different numbers of electrons in them.
- D** There are the same number of protons and neutrons in every isotope of hydrogen.

**75** A chemist weighed two different carbon atoms and found that one of them had a weight of 14 atomic mass units and the other had a weight of 12 atomic mass units. Which of the following is the reason for the difference in weight?

- A** The two atoms had different numbers of protons.
- B** The two atoms had different numbers of electrons.
- C** The two atoms had different numbers of neutrons.
- D** The two atoms were at different temperatures.



## Standards Practice: Periodic Table

**7.c.** Students know substances can be classified by their properties, including their melting temperature, density, hardness, and thermal and electrical conductivity.

**76** A chemist analyzed an unknown material and found that it was hard, malleable, and shiny. The material could be

- A** neon.
- B** oxygen.
- C** copper.
- D** chlorine.

**77** Naomi placed one end of a steel spoon in a beaker of water and heated the beaker. Which question is best tested by Naomi's experiment?

- A** What type of reaction is fire?
- B** How long will the water take to boil?
- C** What are the chemical properties of steel?
- D** How well does steel conduct heat?

**78** Most metallic elements have all of these properties EXCEPT

- A** a high melting point.
- B** being a good conductor of electricity.
- C** being easily crumbled into pieces.
- D** a shiny luster.



## Standards Practice: Density and Buoyancy

All objects experience a buoyant force when immersed in a fluid. As a basis for understanding this concept:

**8.a.** Students know density is mass per unit volume.

**79** Which quantity below could be the average density of the Earth?

- A 5,515.3 kg/m
- B 5,515.3 kg/m<sup>3</sup>
- C 5,515.3 m/kg<sup>3</sup>
- D 5,515.3 kg

**80** A student plotted the mass and volume of five different samples of the same mineral as shown on the graph above. She calculated the density using the formula  $D = M/V$ . The density she recorded was most likely measured in

- A grams
- B cubic centimeters
- C pounds per square inch
- D grams per cubic centimeter

**8.b.** Students know how to calculate the density of substances (regular and irregular solids and liquids) from measurements of mass and volume.

**81** If an object has a mass of 39 grams and a density of 3 grams per cubic milliliter, what is its volume in milliliters?

- A 42 mL
- B 1/13 mL
- C 13 mL
- D 117 mL

**8.c.** Students know the buoyant force on an object in a fluid is an upward force equal to the weight of the fluid the object has displaced.

**82** Paige drops a ball into a swimming pool and it sinks to the bottom. Which of the following is true?

- A The buoyant force is equal to the ball's weight.
- B There is no buoyant force on the ball.
- C The ball's weight is greater than the buoyant force.
- D The buoyant force is less than the ball's weight.

**83** A floating dock is anchored in the middle of a lake. The dock weighs 115 kg. The buoyant force keeping the dock afloat is equal to

- A the mass of the dock.
- B the weight of the dock.
- C the mass of the water displaced.
- D the weight of the water displaced.

**8.d.** Students know how to predict whether an object will float or sink.

**84** According to Archimedes' principle, a boat floats because \_\_\_\_\_.

- A there is less air pressure above water than below it
- B the weight of the water the boat displaces is equal to the buoyant force on the boat
- C the weight of the water the boat displaces is greater than the buoyant force on the boat
- D the weight of the water the boat displaces is less than the buoyant force on the boat



## Standards Practice: Investigation and Experimentation

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:

### 9.a. Plan and conduct a scientific investigation to test a hypothesis.

**85** Which of the following is not a benefit of scientifically obtained evidence?

- A repeatability
- B believability
- C ability to evaluate relative merit
- D permanence

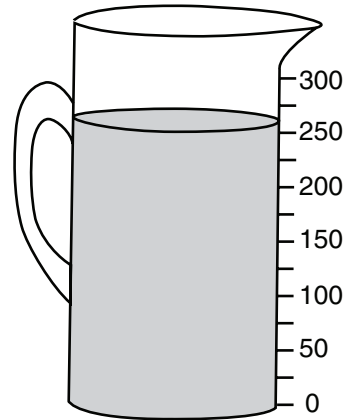
**86** In an experiment designed to determine if a specific brand of cat food is causing cats to meow excessively, it would be best to

- A keep feeding cats with the specific brand of cat food and record the results.
- B mix together the specific brand of cat food with another brand of food and feed to cats.
- C let some of the cats drink water with the specific brand of food.
- D feed some cats with the specific brand of cat food and other cats with another brand.

**87** Beth has been assigned a laboratory project. Which of these would be a poor scientific method for her to use to complete the project?

- A referring to prior knowledge
- B using technology
- C keeping a lab notebook
- D imposing personal values

### 9.b. Evaluate the accuracy and reproducibility of data.



**88** Mr. Levitz poured orange juice into a container. About how much orange juice is most likely in the container?

- A 260 hectoliters
- B 260 kiloliters
- C 260 liters
- D 260 milliliters

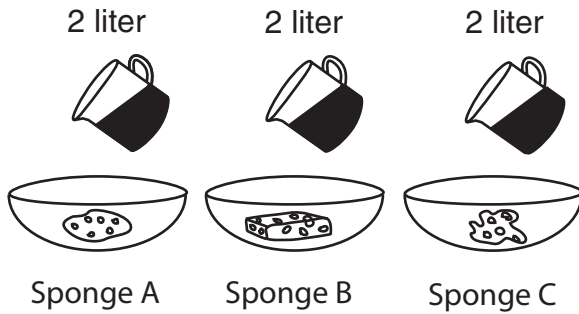
**89** Josephine used both of her hands to measure the width of a table. She determined it was 5 hands wide the first time she measured it. She later re-measured the table and found that it was only 4 1/2 hands wide. How could Josephine improve the reproducibility of her measurement?

- A measure her hands with a ruler
- B use her fingers instead
- C measure the table's length and height
- D use only one of her hands



## Standards Practice: Investigation and Experimentation

**9.c.** Distinguish between variable and controlled parameters in a test.



**90** Which of these questions would most likely be answered by the experimental setup pictured above?

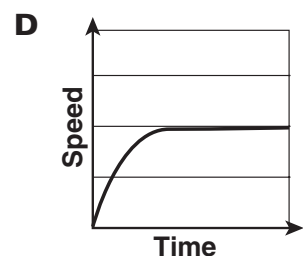
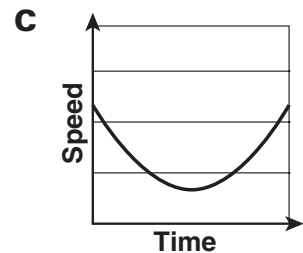
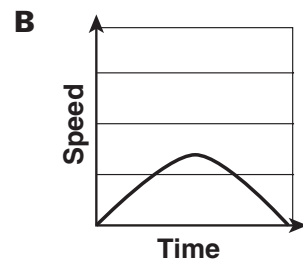
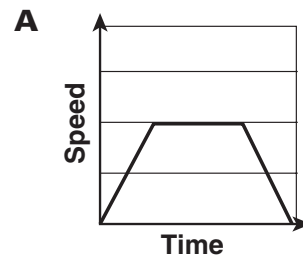
- A** How does room temperature affect water?
- B** Which sponge is the most absorbent?
- C** How fast will the water evaporate?
- D** Which sponge cleans the best?

**91** In the picture above, which of the following could be changed without affecting the results of the experiment?

- A** three liters of water could be used
- B** three different sponges could be used
- C** three different liquids could be used
- D** the sponges could be placed into the water

**9.d.** Recognize the slope of the linear graph as the constant in the relationship  $y = kx$  and apply this principle in interpreting graphs constructed from data.

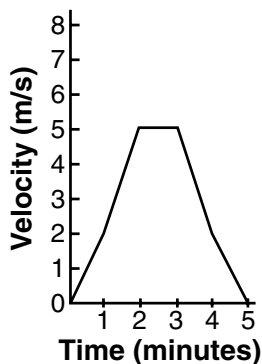
**92** Balaune rides her bike home. At the beginning of her trip, she speeds up, then she rides at a constant rate, and at the end of the trip she slows down. Which graph best represents Balaune's acceleration?



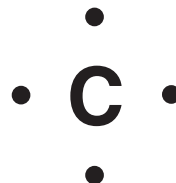


## Standards Practice: Investigation and Experimentation

**9.e.** Construct appropriate graphs from data and develop quantitative statements about the relationships between variables.



- 93** While riding the bus home, Emilio graphs his acceleration. The time interval on the graph above when Emilio was slowing down is
- A** from 0 minutes to 2 minutes
  - B** from 3 minutes to 5 minutes
  - C** from 4 minutes to 5 minutes
  - D** from 1 minutes to 5 minutes
- 94** During the time interval between 4 and 5 minutes, Emilio slowed down. This type of acceleration is called
- A** positive
  - B** reverse
  - C** negative
  - D** forward



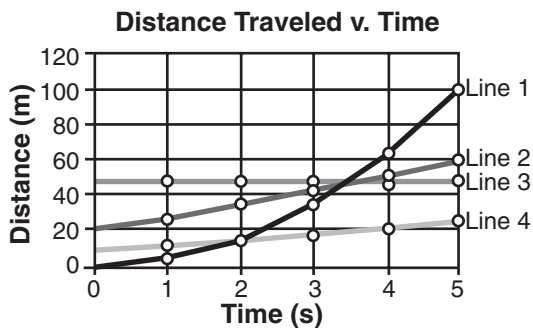
- 95** The illustration above shows a way of representing
- A** the number of electrons carbon has
  - B** the number of bonding electrons carbon has
  - C** the number of protons carbon has
  - D** the number of neutrons carbon has
- 96** Under which heading in a table of contents would information about elements with eight electrons in their outer level be found?
- A** Alkali Metals
  - B** Halogens
  - C** Noble Gases
  - D** Isotopes



## Standards Practice: Investigation and Experimentation

**9.f.** Apply simple mathematic relationships to determine a missing quantity in a mathematic expression, given the two remaining terms (including speed = distance/time, density = mass/volume, force = pressure  $\times$  area, volume = area  $\times$  height).

**97** The graph below shows the distance traveled by four objects over a period of 5 s.



What was the average speed of the object represented by Line 1?

- A 100 m/s
- B 60 m/s
- C 40 m/s
- D 20 m/s

**98** If Shannon wants to calculate the volume of a brick, which of the following facts would be most useful?

- A Its mass is 5 kg.
- B Its density is  $3.125 \text{ g/cm}^3$ .
- C It measures 20 cm by 10 cm by 8 cm.
- D Its weight is 49 N.

**99** Shannon calculates a brick's volume using the information above. What answer does Shannon record?

- A  $3.125 \text{ cm}^3$
- B  $3.125 \text{ g/cm}^3$
- C  $1600 \text{ cm}^3$
- D  $1600 \text{ g/cm}^3$

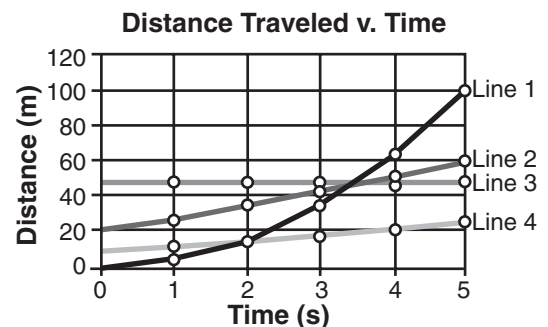
**100** A student is given a 5.4 g mineral sample. She determines that the volume of her sample is  $2 \text{ cm}^3$ . What is the density of her mineral?

- A  $5.4 \text{ g/cm}^3$
- B  $2.0 \text{ g/cm}^3$
- C  $2.7 \text{ g/cm}^3$
- D  $3.4 \text{ g/cm}^3$

**101** Bogdan found that the slope of a line was equal to the density of the sample material. What units did he use to record density?

- A grams
- B cubic centimeters
- C pounds per square inch
- D grams per cubic centimeter

**9.g.** Distinguish between linear and nonlinear relationships on a graph of data.



**102** Based on the graph above, which describes a non-linear relationship?

- A Line 1
- B Line 2
- C Line 3
- D Line 4



## Self-Assessment Test

**1** Which is a force?

- A 80 km/h east
- B 17.2 kg
- C 78 mL
- D 14.8 N to the right

**2** Which of the following statements best describes speed?

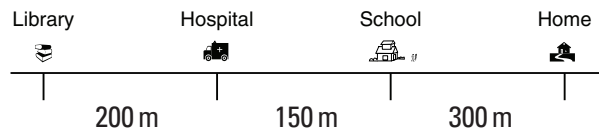
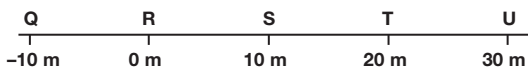
- A change in distance divided by change in time
- B change in time divided by change in distance
- C change in acceleration divided by change in time
- D change in velocity divided by change in time

**3** The color of a star is determined by its surface temperature. The coolest stars are about  $3200^{\circ}\text{C}$ . To what stellar color does this correspond?

- A blue
- B red
- C white
- D yellow

**4** Jason walks from Point R to Point U. Then he walks to Point Q and finally back to Point R. According to this information, which of the following represents Jason's displacement from Point R?

- A 12 m
- B 9 m
- C 0 m
- D 7 m



**5** If school is the reference point, how would you describe the position of the hospital in relation to the school?

- A  $-100$  m
- B 400 m
- C 200 m
- D  $-200$  m

**6** The seasons on Earth are caused by Earth's rotation, revolution, and

- A total number of days in a year.
- B total number of days in a month.
- C tilt on its axis.
- D hours of daylight.

**7** Logan records the number of absences in his school over one week. Which of the following illustrations would best display this data?

- A bar graph
- B pie graph
- C drawing
- D photograph

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

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



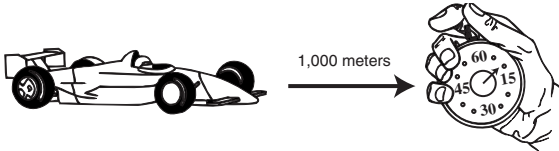
## Self-Assessment Test

- 9** Which of the following is the LEAST important consideration when calculating velocity?
- A** mass  
**B** direction  
**C** distance  
**D** time
- 10** Ionic compounds are usually formed by ionic bonding between metals and nonmetals. Which of the following is *not* an ionic compound?
- A** NaBr  
**B** MgCl<sub>2</sub>  
**C** H<sub>2</sub>O  
**D** KI
- 11** A student made a list of large molecules found in all living organisms for her science homework. Which list is hers?
- A**

Water
Salt
Fats
Proteins
- B**

Fats Proteins
Minerals
Water
- C**

DNA
Fats
Proteins
Carbohydrates
- D**

Salt
Fats Water
Carbohydrates
- 12** How many protons are in one helium atom?
- A** 1  
**B** 2  
**C** 4  
**D** 6
- 
- 13** What is probably being measured in the diagram above?
- A** speed  
**B** engine temperature  
**C** rate of tire wear  
**D** gasoline mileage
- 14** The Moon is visible to us because the Moon
- A** reflects light from the Sun  
**B** reflects light from Earth  
**C** produces light through fusion  
**D** produces light through combustion
- 15** Which element is carbon LEAST LIKELY to combine with in an organic compound?
- A** helium  
**B** hydrogen  
**C** sulfur  
**D** oxygen



## Self-Assessment Test

- 16** A 0.5-kg toy ship floats in the bathtub. The weight of the water it displaces must be
- A** equal to 0.5 kg.
  - B** equal to 1 kg.
  - C** greater than 0.5 kg.
  - D** less than 0.5 kg.

- 17** In the table below, which planetary system has the greatest gravitational force acting between the planet and its moon?

**Mass and Distance Data for Planets and Their Moons**

Planetary System	Planet mass ( $2 \times 10^{22}$ kilograms)	Moon mass ( $2 \times 10^{22}$ kilograms)	distance from planet ( $2 \times 10^6$ kilometers)
1	600	6	2
2	600	6	3
3	600	12	2
4	600	12	1

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

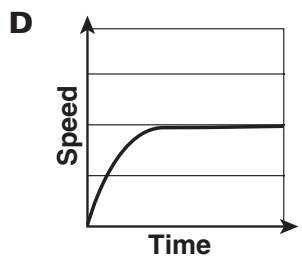
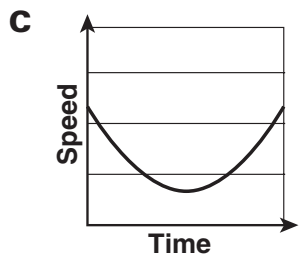
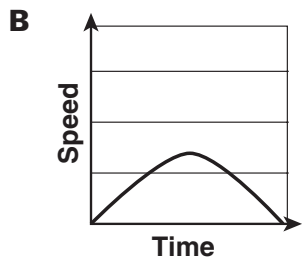
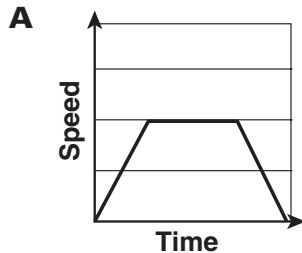
Atomic Mass	Density

- 18** This chart above would most likely be used in an experiment designed to answer which of the following questions?
- A** Does an element's density increase when its temperature is increased?
  - B** Which substances will float on water?
  - C** Does an element's density increase as its atomic mass increases?
  - D** Are solids more dense than liquids?



## Self-Assessment Test

- 19** Grant ran up a large hill and back down the other side. Which graph most likely represents his speed?



- 20** Karl conducted an experiment, following the scientific method as closely as he could. In the end, his data appeared to prove his hypothesis. What should Karl do?

- A** assume he made a mistake  
**B** do the experiment again  
**C** change his hypothesis  
**D** consider his hypothesis is correct

- 21** A teacher drives between four different locations during a day. The table shows the distances between the locations and the time it took the teacher to drive each part of the trip. During which part was the teacher's average speed the greatest?

Distance/Time Table

Trip	Distance (kilometers)	Time (minutes)
Home to school	12	8
School to store	16	9
Store to post office	11	15
Post office to home	14	12

- A** home to school  
**B** school to store  
**C** store to post office  
**D** post office to home



## Self-Assessment Test

**22** Which of the following is an example of a chemical change?

- A** sugar cooked and burned into a caramel
- B** a loaf of bread getting sliced
- C** an ice cube melting
- D** clay being molded into a flower pot

**23** The density of water is 1 g/mL. An object that is less dense than water will float. Kerry lists the density of four unknown objects in the table below.

**Density of Four Unknown Objects**

Object	Density
W	1.05 g/mL
X	0.08 g/mL
Y	0.2 g/mL
Z	0.51 g/mL

Which object will sink when placed in water?

- A** object W
- B** object X
- C** object Y
- D** object Z

**24** In a tug-of-war, two children pull with a force of 150 N each while one adult pulls in the opposite direction with a force of 300 N. Describe the motion, if any, of the rope in terms of net force and acceleration.

- A** no motion
- B** accelerates to the right
- C** shifts upward
- D** accelerates to the left

**25** A planet's rotation on its axis determines the length of its \_\_\_\_\_.

- A** days
- B** months
- C** years
- D** seasons

**26** The table lists the magnitude and direction of forces on a wagon sitting on flat ground.

**Forces on a Wagon**

Force	Direction	Magnitude (newtons)
F1	Right	500
F2	Left	25
F3	Up	100
F4	Down	100

What will the motion of the wagon be?

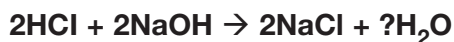
- A** no motion
- B** accelerate to the left
- C** accelerate to the right
- D** move at a constant speed



## Self-Assessment Test

**27** All chemical equations follow the law of conservation of mass. Which number should be used in place of the question mark to balance the equation below?

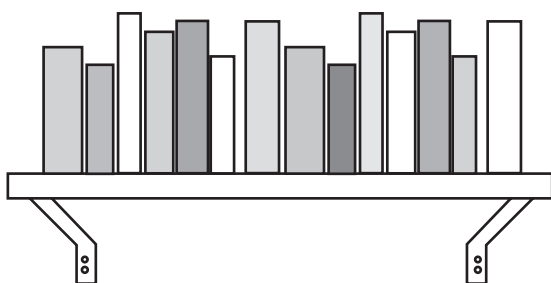
- A** 1
- B** 2
- C** 0
- D** 4



ANTACIDS	SOAP	AMMONIA
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**28** Which of the following belongs with the group above?

- A** Lemon juice
- B** Vinegar
- C** Oven cleaner
- D** Tomatoes



**29** Which of the following best describes what is happening to the books in the picture above?

- A** The books are accelerating.
- B** The books are pushing the shelf.
- C** The normal force is too great.
- D** The forces on the books are not balanced.

**30** An astronomer measured the distance between two stars. The distance the astronomer recorded was probably measured in

- A** light-years
- B** centimeters
- C** tons
- D** inches

**31** What could cause bubbles and vapor to form when two substances come in contact with each other?

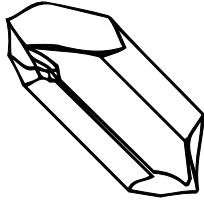
- A** melting point
- B** chemical reaction
- C** change in mass
- D** conservation of mass

**32** All of the following are ways in which atoms can form bonds with other atoms EXCEPT \_\_\_\_\_.

- A** losing electrons
- B** sharing electrons
- C** sharing neutrons
- D** gaining electrons



## Self-Assessment Test

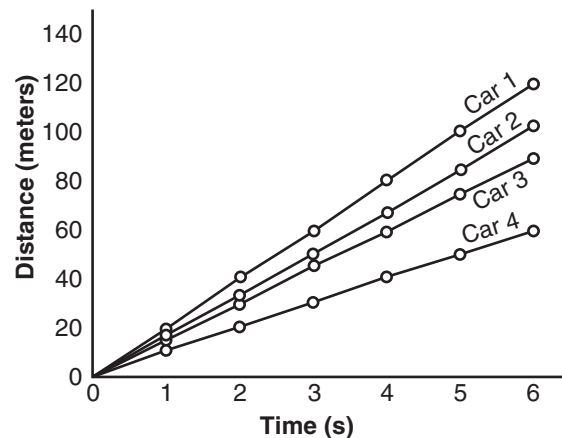


- 33** When conditions permit, many minerals form crystals with elaborate geometric patterns. The crystalline structure of quartz shown in the diagram above is due to \_\_\_\_\_.
- A** the types of elements in the crystal  
**B** the arrangement of atoms in the crystal  
**C** how long ago the crystal formed  
**D** the shape of the surrounding rocks
- 34** Covalent bonds occur between nonmetals that share electrons. Which of the following is *not* an example of covalent bonding?
- A** two bonded chlorine atoms  
**B** an atom of carbon bonded to oxygen  
**C** an atom of magnesium bonded to sulfur  
**D** an atom of carbon bonded to hydrogen
- 35** Trina wanted to find out which of her rubber balls can bounce the highest. She took the first ball and dropped it onto the cement sidewalk. She then dropped the second ball onto the grass. She recorded how high each ball bounced. Her experiment could be improved by
- A** measuring the time it takes for each ball to reach its maximum height.  
**B** bouncing both balls on one of the surfaces.  
**C** dropping the second ball from higher.  
**D** bouncing the ball on the grass two times.

- 36** Which liquid in the table below has the greatest density?

Object	Mass (grams)	Volume (milliliters)
Liquid A	5	5
Liquid B	18	10
Liquid C	36	12
Liquid D	54	20

- A** Liquid A  
**B** Liquid B  
**C** Liquid C  
**D** Liquid D



- 37** The lines on the graph above represent cars in a race. What was the average speed of the losing car?
- A** 120 m/s  
**B** 4 m/s  
**C** 60 m/s  
**D** 10 m/s



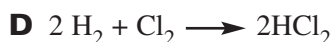
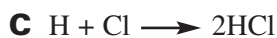
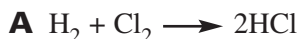
## Self-Assessment Test

- 38** The following elements are important components of organic compounds found in all living organisms EXCEPT
- A** hydrogen.
  - B** argon.
  - C** oxygen.
  - D** phosphorous.
- 39** A rolling ball comes to rest. Which is the most likely cause?
- A** electricity
  - B** friction
  - C** gravity
  - D** power
- 40** Which of the following should be added to a chemical reaction to slow it down?
- A** reactant
  - B** catalyst
  - C** enzyme
  - D** inhibitor
- 41** A train travels at a constant speed of 125 kilometers per hour. How many minutes does it take the train to travel 25 kilometers?
- A** 10 minutes
  - B** 12 minutes
  - C** 15 minutes
  - D** 20 minutes
- 42** Which of the following is *not* a true statement about a liquid?
- A** The liquid takes the shape of its container.
  - B** The molecules can move past one another.
  - C** If poured into a larger container, the volume of the liquid would increase.
  - D** The molecules have enough kinetic energy to overcome some attractive forces.
- 43** Which of the following correctly describes a difference between a white dwarf star and a red giant star?
- A** White dwarfs are brighter than red giants.
  - B** White dwarfs are smaller in magnitude than red giants.
  - C** White dwarfs have a greater gravitational pull than red giants.
  - D** White dwarfs have cooler surface temperatures than red giants.
- 44** At room temperature, most of the elements on the Periodic Table are
- A** solids.
  - B** semimetals.
  - C** gases.
  - D** liquids.



## Self-Assessment Test

**45** 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?



**46** Sometimes two elements combine to make a new substance with its own special properties. This new substance is an example of

**A** a homogeneous mixture

**B** a heterogeneous mixture

**C** an atom

**D** a compound

**47** An object will float in liquids that are more dense than it is. Ice floats on water because it

**A** cools the water

**B** freezes the water

**C** is less dense than the water

**D** is more dense than the water

**48** Which of the following graphs is not an example of a linear relationship?

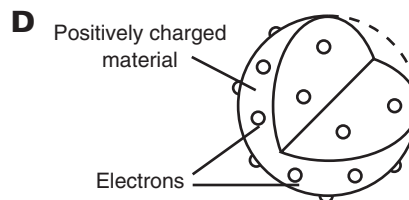
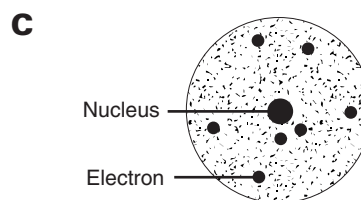
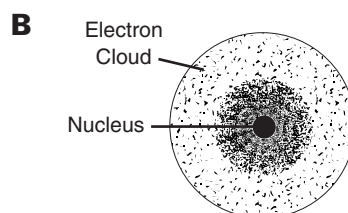
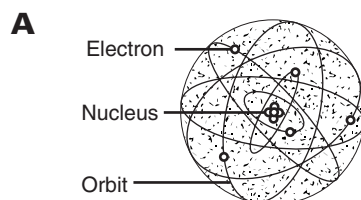
**A** a line that slopes downward

**B** a line that slopes upward

**C** a line that slopes upward then downward

**D** a line that is horizontal

**49** Which of these diagrams below represents the modern model of the atom?



**50** A football maintains a constant speed of 65 km/h. It reaches a height of 20 m before descending to a receiver in the end zone. Which best describes this observation?

**A** the velocity is constant

**B** the velocity changes

**C** the average speed increases

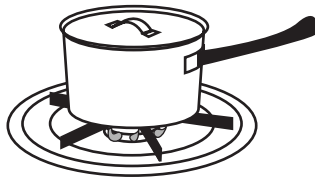
**D** the average speed decreases



## Self-Assessment Test

**51** In which of these would you expect to find a large number of stars?

- A** the solar system
- B** the rings of Saturn
- C** the asteroid belt
- D** the Milky Way galaxy



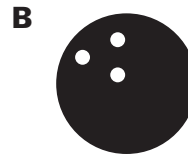
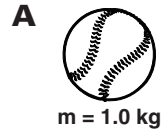
**52** The pot above is being heated to  $150^{\circ}\text{C}$  and contains only water. Which statement is accurate?

- A** The water will change its state.
- B** The water will change its chemical properties.
- C** The water will change its mass.
- D** The water will undergo a chemical reaction.

**53** Which of these facts best explains why a baseball maintains its shape?

- A** Its melting point is close to room temperature.
- B** Its particles are packed tightly.
- C** Gases have loosely packed particles.
- D** Solids can never change shape.

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

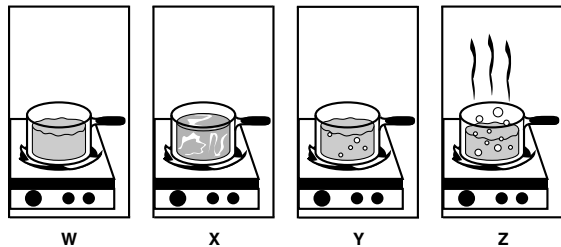


**55** When conducting an experiment, you should never

- A** wash your hands after handling a substance.
- B** report spills immediately.
- C** clean up broken glass yourself.
- D** unplug cords by pulling on the plug, not the cord.



## Self-Assessment Test



**56** In the illustration above, which is the order of the change in the state of water starting as a solid and then undergoing the process of vaporization?

- A** W, Y, X, Z
- B** Z, Y, X, W
- C** X, W, Y, Z
- D** X, W, Z, Y

**57** Which of the following is most likely to be a property of a nonmetal?

- A** It has a hard and shiny surface.
- B** It can be bent into different shapes.
- C** It is a poor conductor of electricity.
- D** It is a good conductor of heat.

**58** When a wood fire burns, it releases heat into the environment. This type of reaction is

- A** endothermic
- B** exothermic
- C** catalytic
- D** endergonic