

CHAPTER 1 REVIEW*Matter and Change***SECTION 1****SHORT ANSWER** Answer the following questions in the space provided.

1. a Technological development of a chemical product often
- (a) lags behind basic research on the same substance.
 - (b) does not involve chance discoveries.
 - (c) is driven by curiosity.
 - (d) is done for the sake of learning something new.
2. d The primary motivation behind basic research is to
- (a) develop new products.
 - (b) make money.
 - (c) understand an environmental problem.
 - (d) gain knowledge.
3. a Applied research is designed to
- (a) solve a particular problem.
 - (b) satisfy curiosity.
 - (c) gain knowledge.
 - (d) learn for the sake of learning.
4. b Chemistry is usually classified as
- (a) a biological science.
 - (b) a physical science.
 - (c) a social science.
 - (d) a computer science.

5. Define the six major branches of chemistry.

organic chemistry—the study of carbon-containing compounds

inorganic chemistry—the study of non-organic substances

physical chemistry—the study of properties of matter, changes that occur in matter,
and the relationships between matter and energy

analytical chemistry—the identification of the composition of materials

biochemistry—the study of the chemistry of living things

theoretical chemistry—the use of mathematics and computers to design and
predict the properties of new compounds

SECTION 1 continued

6. For each of the following types of chemical investigations, determine whether the investigation is *basic research*, *applied research*, or *technological development*. More than one choice may apply.

- | | |
|--|--|
| basic research | a. A laboratory in a major university surveys all the reactions involving bromine. |
| applied research/
technical development | b. A pharmaceutical company explores a disease in order to produce a better medicine. |
| applied research | c. A scientist investigates the cause of the ozone hole to find a way to stop the loss of the ozone layer. |
| applied research/
technical development | d. A pharmaceutical company discovers a more efficient method of producing a drug. |
| applied research/
technical development | e. A chemical company develops a new biodegradable plastic. |
| applied research | f. A laboratory explores the use of ozone to inactivate bacteria in a drinking-water system. |

7. Give examples of two different instruments routinely used in chemistry.

Answers may include any type of balance and any type of microscope.

8. What are microstructures?

things too small to be seen with the unaided eye

9. What is a chemical?

a substance with a definite composition

10. What is chemistry?

the study of the composition, properties, and interactions of matter

CHAPTER 1 REVIEW*Matter and Change***SECTION 2****SHORT ANSWER** Answer the following questions in the space provided.1. Classify each of the following as a *homogeneous* or *heterogeneous* substance.

- heterogeneous a. iron ore
- homogeneous b. quartz
- heterogeneous c. granite
- homogeneous d. energy drink
- heterogeneous e. oil-and-vinegar salad dressing
- homogeneous f. salt
- homogeneous g. rainwater
- homogeneous h. nitrogen

2. Classify each of the following as a *physical* or *chemical* change.

- physical a. ice melting
- chemical b. paper burning
- chemical c. metal rusting
- physical d. gas pressure increasing
- physical e. liquid evaporating
- chemical f. food digesting

3. Compare a physical change with a chemical change.

A chemical change involves a rearrangement of the atoms of different elements in a substance and the formation substances with different physical properties. A physical change can occur in properties such as the state or shape of a substance, but it will not affect the composition of that substance.

SECTION 2 continued

4. Compare and contrast each of the following terms:

a. *mass* and *matter*

Mass is a measure of the amount of matter. Matter is anything that has mass and takes up space.

b. *atom* and *compound*

All matter is composed of atoms, which are the smallest units of an element that retain the properties of that element. Atoms can come together to form compounds.

c. *physical property* and *chemical property*

Physical properties are characteristics such as color, density, melting point, and boiling point that can be measured without changing the identity of the substance.

Chemical properties relate to how a substance interacts with another substance to form a different substance.

d. *homogeneous mixture* and *heterogeneous mixture*

A homogeneous mixture has a uniform composition. A heterogeneous mixture is not uniform.

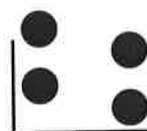
5. Using circles to represent particles, draw a diagram that compares the arrangement of particles in the solid, liquid, and gas states.



Solid



Liquid



Gas

6. How is energy involved in chemical and physical changes?

Energy is either absorbed or given off in all chemical and physical changes, but it is neither created nor destroyed. It simply assumes a different form, or it is moved from one place to another.

CHAPTER 1 REVIEW*Matter and Change***SECTION 3****SHORT ANSWER** Answer the following questions in the space provided.

1. A horizontal row of elements in the periodic table is called a(n) period.
2. The symbol for the element in Period 2, Group 13, is B.
3. Elements that are good conductors of heat and electricity are metals.
4. Elements that are poor conductors of heat and electricity are nonmetals.
5. A vertical column of elements in the periodic table is called a(n) group, or family.
6. The ability of a substance to be hammered or rolled into thin sheets is called malleability.
7. Is an element that is soft and easy to cut cleanly with a knife likely to be a metal or a nonmetal? metal
8. The elements in Group 18, which are generally unreactive, are called noble gases.
9. At room temperature, most metals are solids.
10. Name three characteristics of most nonmetals.
They are brittle, are poor conductors of heat and electricity, and have low boiling points.
11. Name three characteristics of metals.
They are malleable, ductile, and good conductors of heat and electricity, and they have a metallic (shiny) luster.
12. Name three characteristics of most metalloids.
They are semiconductors of electricity, solid at room temperature, and less malleable than metals.
13. Name two characteristics of noble gases.
They are in the gas state at room temperature and are generally unreactive.

SECTION 3 continued

14. What do elements of the same group in the periodic table have in common?

Elements of the same group share similar chemical properties.

15. Within the same period of the periodic table, how do the properties of elements close to each other compare with the properties of elements far from each other?

The properties of elements that are close to each other in the same period tend to be more similar than the properties of elements that are far apart. Physical and chemical properties change somewhat regularly across a period.

16. You are trying to manufacture a new material, but you would like to replace one of the elements in your new substance with another element that has similar chemical properties. How would you use the periodic table to choose a likely substitute?

You would consider an element of the same vertical column, or group, because elements in the same group have similar chemical properties.

17. What is the difference between a family of elements and elements in the same period?

Family is another name for *group*, or elements in the same vertical column.

Elements in the same period are in the same horizontal row.

18. Complete the table below by filling in the spaces with correct names or symbols.

Name of element	Symbol of element
Aluminum	Al
Calcium	Ca
Manganese	Mn
Nickel	Ni
Potassium	K
Cobalt	Co
Silver	Ag
Hydrogen	H

CHAPTER 1 REVIEW*Matter and Change***MIXED REVIEW****SHORT ANSWER** Answer the following questions in the space provided.

1. Classify each of the following as a
- homogeneous*
- or
- heterogeneous*
- substance.

<u>homogeneous</u>	a. sugar	<u>homogeneous</u>	d. plastic wrap
<u>homogeneous</u>	b. iron filings	<u>heterogeneous</u>	e. cement sidewalk
<u>heterogeneous</u>	c. granola bar		

2. For each type of investigation, select the most appropriate branch of chemistry from the following choices:
- organic chemistry*
- ,
- analytical chemistry*
- ,
- biochemistry*
- ,
- theoretical chemistry*
- . More than one branch may be appropriate.

<u>analytical chemistry</u>	a. A forensic scientist uses chemistry to find information at the scene of a crime.
<u>theoretical chemistry/ biochemistry</u>	b. A scientist uses a computer model to see how an enzyme will function.
<u>biochemistry</u>	c. A professor explores the reactions that take place in a human liver.
<u>organic chemistry</u>	d. An oil company scientist tries to design a better gasoline.
<u>analytical chemistry</u>	e. An anthropologist tries to find out the nature of a substance in a mummy's wrap.
<u>biochemistry/ analytical chemistry</u>	f. A pharmaceutical company examines the protein on the coating+ of a virus.

3. For each of the following types of chemical investigations, determine whether the investigation is
- basic research*
- ,
- applied research*
- , or
- technological development*
- . More than one choice may apply.

<u>basic research</u>	a. A university plans to map all the genes on human chromosomes.
<u>applied research</u>	b. A research team intends to find out why a lake remains polluted to try to find a way to clean it up.
<u>applied research/ technological development</u>	c. A science teacher looks for a solvent that will allow graffiti to be removed easily.
<u>basic research/ applied research</u>	d. A cancer research institute explores the chemistry of the cell.
<u>basic research</u>	e. A professor explores the toxic compounds in marine animals.

MIXED REVIEW continued

4. Use the periodic table to identify the name, group number, and period number of the following elements:

chlorine, Group 17, Period 3 a. Cl

magnesium, Group 2, Period 3 b. Mg

tungsten, Group 6, Period 6 c. W

iron, Group 8, Period 4 d. Fe

tin, Group 14, Period 5 e. Sn

5. What is the difference between extensive and intensive properties?

Extensive properties depend on the amount of matter present; intensive properties do not.

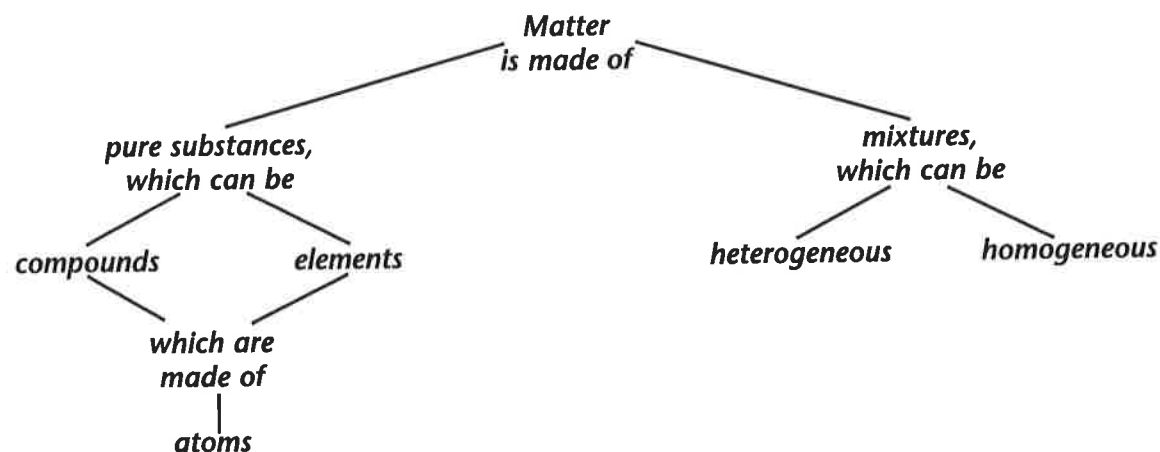
6. Consider the burning of gasoline and the evaporation of gasoline. Which process represents a chemical change and which represents a physical change? Explain your answer.

The burning of gasoline represents a chemical change because the gasoline is being changed into substances with different identities. Evaporation involves a physical change; the identity of gasoline remains unchanged.

7. Describe the difference between a heterogeneous mixture and a homogeneous mixture, and give an example of each.

A heterogeneous mixture, such as blood, is made of components with different physical properties. A homogeneous mixture, such as stainless steel, has a single set of physical properties.

8. Construct a concept map that includes the following terms: *atom, element, compound, pure substance, mixture, homogeneous, and heterogeneous.*



CHAPTER 2 REVIEW*Measurements and Calculations***SECTION 1****SHORT ANSWER** Answer the following questions in the space provided.

1. Determine whether each of the following is an example of *observation and data*, a *theory*, a *hypothesis*, a *control*, or a *model*.

_____ **observation and data**

- a. A research team records the rainfall in inches per day in a prescribed area of the rain forest. The square footage of vegetation and relative plant density per square foot are also measured.

_____ **observation and data**

- b. The intensity, duration, and time of day of the precipitation are noted for each precipitation episode. The types of vegetation in the area are recorded and classified.

_____ **control**

- c. The information gathered is compared with the data on the average precipitation and the plant population collected over the last 10 years.

_____ **hypothesis**

- d. The information gathered by the research team indicates that rainfall has decreased significantly. They propose that deforestation is the primary cause of this phenomenon.

2. “When 10.0 g of a white, crystalline sugar are dissolved in 100. mL of water, the solution is observed to freeze at -0.54°C , not 0.0°C . The system is denser than pure water.” Which parts of these statements represent quantitative information, and which parts represent qualitative information?

Quantitative values include the mass of sugar, volume of water, and observed

freezing point. Qualitative properties are the color and state of the sugar and the

claim of greater density.

3. Compare and contrast a model with a theory.

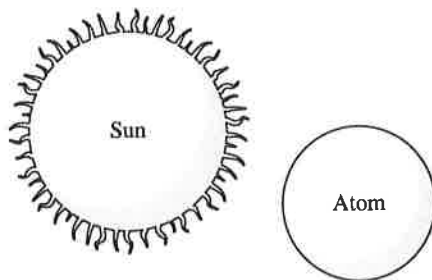
Theories are broad generalizations used to explain observations. Models are

a physical object used to illustrate or explain complex concepts or an explanation of

how phenomena occur and how data and events are related.

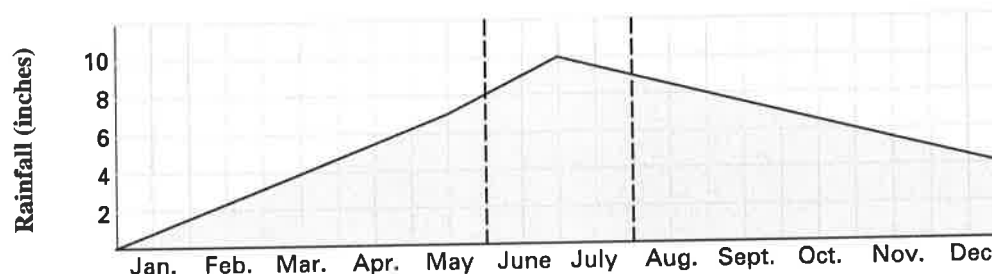
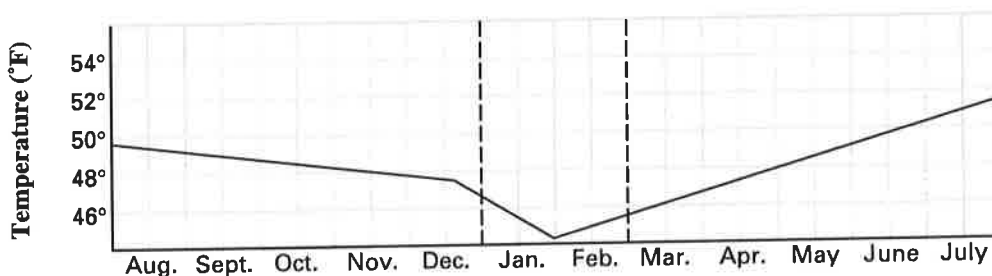
SECTION 1 continued

4. Evaluate the models shown below. Describe how the models resemble the objects they represent and how they differ from the objects they represent.



The model of the sun accurately shows that the sun is round and has a fiery surface,
but the model is much smaller than the real sun and does not show the sun's
composition. The model of an atom accurately shows that an atom is a particle, but
the model is much larger than a real atom and does not depict an atom's
composition or shape.

5. c How many different variables are represented in the two graphs shown below?
 a. one b. two c. three d. four



CHAPTER 2 REVIEW*Measurements and Calculations***SECTION 2****SHORT ANSWER** Answer the following questions in the space provided.

1. Complete the following conversions:

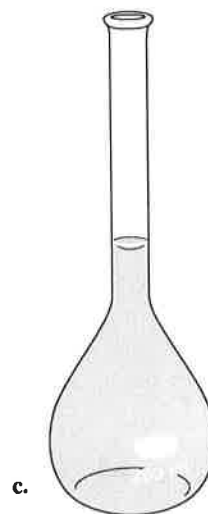
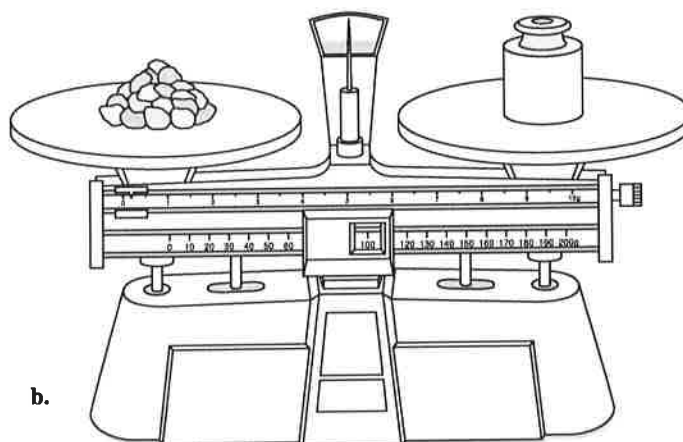
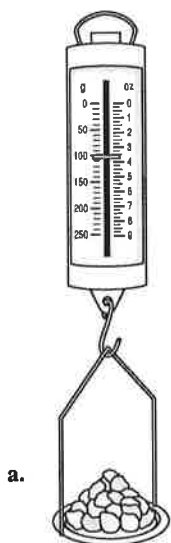
a. 100 mL = 0.1 L

b. 0.25 g = 25 cg

c. 400 cm³ = 0.4 L

d. 400 cm³ = 0.0004 m³

2. For each measuring device shown below, identify the quantity measured and tell when it would remain constant and when it would vary.



Device a measures weight (the effect of the gravitational force on mass), which changes with location on Earth and when measured on a different planet or moon.
Device b measures mass, which does not change with location because gravity affects both the measured body and the mass standard equally.
Device c measures volume of a liquid, which changes slightly with temperature and pressure. Weight, mass, and volume do not change with the shape of the object.

SECTION 2 continued

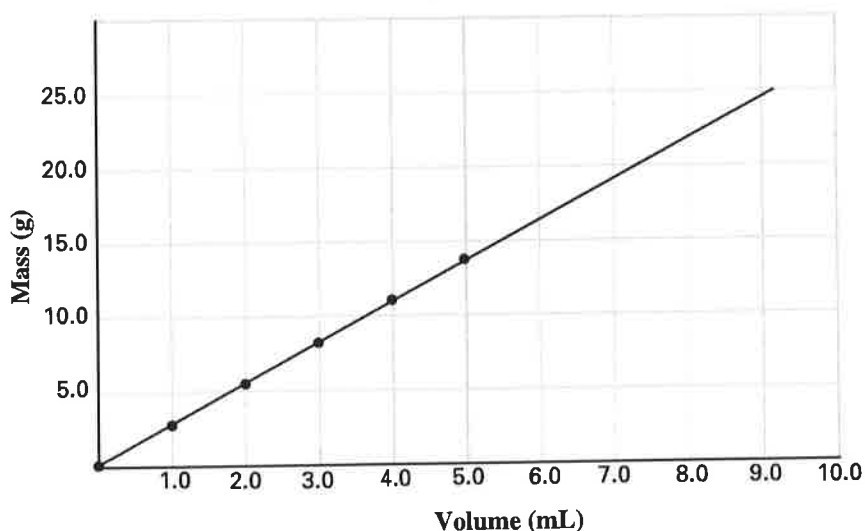
3. Use the data found in **Table 4** on page 38 of the text to answer the following questions:

- _____ **sink** _____ a. If ice were denser than liquid water at 0°C, would it float or sink in water?
- _____ **kerosene** _____ b. Water and kerosene do not dissolve readily in one another. If the two are mixed, they quickly separate into layers. Which liquid floats on top?
- _____ **mercury** _____ c. The other liquids in **Table 4** that do not dissolve in water are gasoline, turpentine, and mercury. Which of these liquids would settle to the bottom when mixed with water?

4. Use the graph of the density of aluminum below to determine the approximate mass of aluminum samples with the following volumes.

- 22 g a. 8.0 mL
- 4 g b. 1.50 mL
- 20 g c. 7.25 mL
- 9 g d. 3.50 mL

Mass vs. Volume of Aluminum



PROBLEMS Write the answer on the line to the left. Show all your work in the space provided.

5. 27.0 g Aluminum has a density of 2.70 g/cm³. What would be the mass of a sample whose volume is 10.0 cm³?

6. 14 cm A certain piece of copper wire is determined to have a mass of 2.00 g per meter. How many centimeters of the wire would be needed to provide 0.28 g of copper?

CHAPTER 2 REVIEW

Measurements and Calculations

SECTION 3

SHORT ANSWER Answer the following questions in the space provided.

1. Report the number of significant figures in each of the following values:

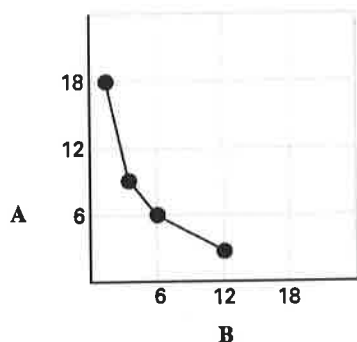
- 3 a. 0.002 37 g 2 d. 64 mL
 4 b. 0.002 037 g 2 e. 1.3×10^2 cm
 3 c. 350. J 3 f. 1.30×10^2 cm

2. Write the value of the following operations using scientific notation.

- 10^{-1} a. $\frac{10^3 \times 10^{-6}}{10^{-2}}$
 4×10^{-2} b. $\frac{8 \times 10^3}{2 \times 10^5}$
 4.3×10^4 c. $3 \times 10^3 + 4.0 \times 10^4$

3. The following data are given for two variables, A and B:

A	B
18	2
9	4
6	6
3	12



a. In the graph provided, plot the data.

 inversely proportional

 No

 $A \times B = k$

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- b. Are A and B directly or inversely proportional?
c. Do the data points form a straight line?
d. Which equation fits the relationship shown by the data?
 $\frac{A}{B} = k$ (a constant) or $A \times B = k$ (a constant)
e. What is the value of k?

SECTION 3 continued

4. Carry out the following calculations. Express each answer to the correct number of significant figures and use the proper units.

$$\underline{\quad 40.0 \text{ m} \quad} \quad \text{a. } 37.26 \text{ m} + 2.7 \text{ m} + 0.0015 \text{ m} =$$

$$\underline{\quad 2000 \text{ mL or 2 L} \quad} \quad \text{b. } 256.3 \text{ mL} + 2 \text{ L} + 137 \text{ mL} =$$

$$\underline{\quad 151 \text{ mL} \quad} \quad \text{c. } \frac{300. \text{ kPa} \times 274.57 \text{ mL}}{547 \text{ kPa}} =$$

$$\underline{\quad 100 \text{ mL} \quad} \quad \text{d. } \frac{346 \text{ mL} \times 200 \text{ K}}{546.4 \text{ K}} =$$

5. Round the following measurements to three significant figures.

$$\underline{\quad 22.8 \text{ g} \quad} \quad \text{a. } 22.77 \text{ g}$$

$$\underline{\quad 14.6 \text{ m} \quad} \quad \text{b. } 14.62 \text{ m}$$

$$\underline{\quad 9.31 \text{ L} \quad} \quad \text{c. } 9.3052 \text{ L}$$

$$\underline{\quad 87.6 \text{ cm} \quad} \quad \text{d. } 87.55 \text{ cm}$$

$$\underline{\quad 30.2 \text{ g} \quad} \quad \text{e. } 30.25 \text{ g}$$

PROBLEMS Write the answer on the line to the left. Show all your work in the space provided.

6. A pure solid at a fixed temperature has a constant density. We know that

$$\text{density} = \frac{\text{mass}}{\text{volume}} \text{ or } D = \frac{m}{V}$$

$$\underline{\quad \text{directly proportional} \quad} \quad \text{a. Are mass and volume directly proportional or inversely proportional for a fixed density?}$$

$$\underline{\quad 6.0 \text{ cm}^3 \quad} \quad \text{b. If a solid has a density of } 4.0 \text{ g/cm}^3, \text{ what volume of the solid has a mass of } 24 \text{ g?}$$

7. A crime-scene tape has a width of 13.8 cm. A long strip of it is torn off and measured to be 56 m long.

$$\underline{\quad 5600 \text{ cm} \quad} \quad \text{a. Convert } 56 \text{ m into centimeters.}$$

$$\underline{\quad 7.7 \times 10^4 \text{ cm}^2 \quad} \quad \text{b. What is the area of this rectangular strip of tape, in cm}^2?$$

CHAPTER 2 REVIEW*Measurements and Calculations***MIXED REVIEW****SHORT ANSWER** Answer the following questions in the space provided.

1. Match the description on the right to the most appropriate quantity on the left.

- | | |
|----------------------------------|--|
| <u> d </u> 2 m ³ | (a) mass of a small paper clip |
| <u> a </u> 0.5 g | (b) length of a small paper clip |
| <u> f </u> 0.5 kg | (c) length of a stretch limousine |
| <u> e </u> 600 cm ² | (d) volume of a refrigerator compartment |
| <u> b </u> 20 mm | (e) surface area of the cover of this workbook |
| | (f) mass of a jar of peanut butter |

2. a A measured quantity is said to have good accuracy if

- (a) it agrees closely with the accepted value.
 (b) repeated measurements agree closely.
 (c) it has a small number of significant figures.
 (d) all digits in the value are significant.

3. A certain sample with a mass of 4.00 g is found to have a volume of 7.0 mL. To calculate the density of the sample, a student entered $4.00 \div 7.0$ on a calculator. The calculator display shows the answer as 0.571429. Yes a. Is the setup for calculating density correct? 2 b. How many significant figures should the answer contain?

4. It was shown in the text that in a value such as 4000 g, the precision of the number is uncertain. The zeros may or may not be significant.

 1 a. Suppose that the mass was determined to be 4000 g. How many significant figures are present in this measurement? 4.00×10^3 g b. Suppose you are told that the mass lies somewhere between 3950 and 4050 g. Use scientific notation to report the value, showing an appropriate number of significant figures.

5. If you divide a sample's mass by its density, what are the resulting units?

Volume units: for example, $\frac{\text{g}}{\text{g/mL}} = \text{mL}$

MIXED REVIEW continued

6. Three students were asked to determine the volume of a liquid by a method of their choosing. Each performed three trials. The table below shows the results. The actual volume of the liquid is 24.8 mL.

	Trial 1 (mL)	Trial 2 (mL)	Trial 3 (mL)
Student A	24.8	24.8	24.4
Student B	24.2	24.3	24.3
Student C	24.6	24.8	25.0

- _____ **Student C** a. Considering the average of all three trials, which student's measurements show the greatest accuracy?
- _____ **Student B** b. Which student's measurements show the greatest precision?

PROBLEMS Write the answer on the line to the left. Show all your work in the space provided.

7. _____ 2.0×10^2 g A single atom of platinum has a mass of 3.25×10^{-22} g. What is the mass of 6.0×10^{23} platinum atoms?

8. A sample thought to be pure lead occupies a volume of 15.0 mL and has a mass of 160.0 g.

- _____ **10.7 g/mL** a. Determine its density.
- _____ **No** b. Is the sample pure lead? (Refer to **Table 4** on page 38 of the text.)
- _____ **6.0%** c. Determine the percentage error, based on the accepted value for the density of lead.

Answer Key

1 Matter and Change

Section: Chemistry is a Physical Science

- | | |
|------|-------|
| 1. d | 2. a |
| 3. b | 4. d |
| 5. a | 6. d |
| 7. c | 8. c |
| 9. b | 10. c |

Section: Matter and its Properties

- | | |
|------|-------|
| 1. c | 2. a |
| 3. b | 4. a |
| 5. c | 6. d |
| 7. b | 8. a |
| 9. a | 10. c |

Section: Elements

- | | |
|------|-------|
| 1. c | 2. c |
| 3. a | 4. c |
| 5. d | 6. a |
| 7. b | 8. c |
| 9. d | 10. b |

2 Measurements and Calculations

Section: Scientific Method

- | | |
|------|-------|
| 1. d | 2. a |
| 3. c | 4. a |
| 5. d | 6. d |
| 7. c | 8. d |
| 9. b | 10. b |

Section: Units of Measurement

- | | |
|------|-------|
| 1. c | 2. d |
| 3. d | 4. b |
| 5. d | 6. a |
| 7. a | 8. b |
| 9. a | 10. c |

Section: Using Scientific Measurements

- | | |
|------|-------|
| 1. b | 2. b |
| 3. b | 4. b |
| 5. d | 6. b |
| 7. b | 8. c |
| 9. d | 10. c |