

## Chapter 1

Due: 11:00pm on Sunday, January 17, 2010

**Note:** To understand how points are awarded, read your instructor's [Grading Policy](#).

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### The Scientific Method

**Learning Goal:** To understand how the scientific method can be used to search for explanations of nature.

The *scientific method* is a procedure used to search for explanations of nature. The scientific method consists of making observations, formulating hypotheses, designing and carrying out experiments, and repeating this cycle.

*Observations* can be either quantitative or qualitative. *Quantitative observations* are measurements consisting of both numbers and units, such as the observation that ice melts at  $0^{\circ}\text{C}$ . In contrast, *qualitative observations* are observations that do not rely on numbers or units, such as the observation that water is clear.

A *hypothesis* is a tentative explanation of the observations. The hypothesis is not necessarily correct, but it puts the scientist's understanding of the observations into a form that can be tested through experimentation.

Experiments are then performed to test the validity of the hypothesis. *Experiments* are observations preferably made under conditions in which the variable of interest is clearly distinguishable from any others.

If the experiment shows that the hypothesis is incorrect, the hypothesis can be modified, and further experiments can be carried out to test the modified hypothesis. This cycle is repeated, continually refining the hypothesis.

If a large set of observations follow a reproducible pattern, this pattern can be summarized in a *law*—a verbal or mathematical generalization of a phenomenon. For example, over the years people observed that every morning the sun rises in the east, and every night the sun sets in the west. These observations can be described in a law stating, "The sun always rises in the east and sets in the west."

After a great deal of refinement, a hypothesis can lead to a theory. A *theory* is an explanation of why something happens. For example, Newton's theory of gravitation explains why objects tend to fall toward the Earth (as well as explaining the interactions between the Earth and the other planets, etc). However, theories can still be further refined or even replaced. Einstein's theory of general relativity was able to better explain certain astronomical observations related to gravity, and therefore it replaced Newton's theory of gravitation (although Newton's theory still holds true under most everyday conditions). Similarly, the geocentric theory (that the Earth is the center of the universe) was replaced by the heliocentric theory (that the Earth revolves around the sun) based on further observations and testing of predictions. Note that a scientific theory is not the same as the popular definition of a theory—namely, a "guess" or "speculation." Instead, a theory is an explanation that can hold up against repeated experimentation. It may not be perfect, but it is the best explanation possible based on available evidence.

In the course of a conversation, you observe that three of your friends like horror movies. Horror movies happen to be your favorite type of movie as well. You also know that all of these friends were born in the same week that you were, even in the same year.

An astrology-loving friend hypothesizes that people born in that week like horror movies more than other genres of movies. You decide to use the scientific method to test this hypothesis.

**Part A**

What should you do next?

**ANSWER:**

- Come up with a theory to explain why movie preference is related to birth week.
- Perform experiments to test your hypothesis.
- Propose several alternative hypotheses.
- Refine your hypothesis.

*Correct*

**Part B**

Which of the following experiments would best test your hypothesis?

**ANSWER:**

- Ask your friends if they also like the same type of music that you like.
- Interview all of your friends and find out if the ones born in other weeks also like the same types of movies that you like.
- Find other people born in the same week and ask them what their favorite type of movie is.
- Find other people born in the same week and tell them what your favorite movie is. Ask them if they also liked that movie.

*Correct*

You want to be as careful as possible that the variable of interest — namely, favorite movie genre — is clearly distinguishable from any other variables. To do so, first you must be careful to find a random sampling of people who share your birth week, avoiding simply talking to friends with whom you know share common interests. Second, you need to provide your subjects with a questionnaire on which they are asked to circle their favorite genre from a list, so that you are not tempted to interpret their answers in your favor. You must be certain not to tell them what you are seeking to prove or disprove; that way their answers will not be influenced by your stated goal. You must also make the surveys anonymous to ensure that your subjects aren't simply giving you the answers they think you want them to give.

After finding a random sample of 10 people born in the same week as you and your friends, you obtain these results from their questionnaires:

- 4 of them prefer comedies,
- 3 of them prefer dramas,
- 2 of them prefer action movies, and
- 1 of them prefers westerns.

As a control, you also interview 14 random people with birthdays throughout the year. You obtain results similar to the results of your experimental group and your friends:

- 3 of them prefer comedies,
- 4 of them prefer dramas,
- 3 of them prefer action movies, and
- 1 of them prefers westerns

**Part C**

What should you do next?

ANSWER:

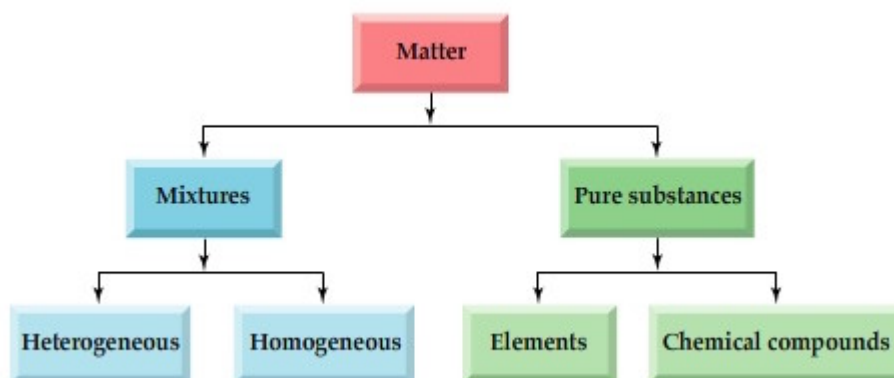
- Refine your hypothesis.
- Come up with a theory to explain why movie preference is only sometimes related to birth week.
- Perform further interviews until you find more people who prefer horror movies.
- Assume that the 10 people you interviewed were lying about their birth week. Conduct further interviews in which you ask movie preference first and only ask about birth week when people say they like horror movies.

*Correct*

The scientific method can be used to examine virtually any idea, not just those in chemistry.

### Classification of Matter

All matter can be classified as either a mixture or a pure substance. Mixtures can be further classified as heterogeneous or homogeneous. Pure substances can be further classified as elements or compounds.



#### Part A

In the following images, the white spheres represent hydrogen atoms and the red spheres represent oxygen atoms. Classify each sample as an element, a compound, or a mixture.

Hint A.1 Define elements, compounds, and mixtures

*Hint not displayed*

Drag each item to the appropriate bin.

ANSWER:



[View](#)

*Correct*

### Part B

Classify each of the following substances as an element, a compound, or a mixture.

#### Hint B.1 Distinguish between elements, compounds, and mixtures

*Hint not displayed*

Drag each item to the the appropriate bin.

ANSWER:



[View](#)

*Correct*

### Part C

Classify the following mixtures as homogenous or heterogeneous.

#### Hint C.1 Define the two types of mixtures

*Hint not displayed*

#### Hint C.2 Descriptions of granite and bronze

*Hint not displayed*

Drag each item to the appropriate bin.

ANSWER:



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*Correct*

A solution is another name for a homogeneous mixture. For example, vodka is a solution of alcohol and water. If something has a percentage value (such as 40% alcohol by volume), this is a good indication that you are dealing with a solution and not a pure substance.

## Chemical Properties and Physical Properties

Substances have both *chemical properties* and *physical properties*.

### Part A

Which of the following properties of iron are chemical properties?

**Hint A.1 Chemical properties definition**

*Hint not displayed*

**Hint A.2 Physical properties definition**

*Hint not displayed*

**Check all that apply.**

ANSWER:

- It is shiny.
- It rusts in water.
- It reacts with chlorine to form iron chloride.
- It has a mass of 112.23 g.

*Correct*

### Part B

Which of the following properties of an ice cube are physical properties?

**Hint B.1 Chemical properties definition**

*Hint not displayed*

**Hint B.2 Physical properties definition**

*Hint not displayed*

**Check all that apply.**

ANSWER:

- It is hard.
- It is cold to the touch.
- It reacts with carbon dioxide to form carbonic acid.
- It has a mass of 27.3 g.

*Correct*

## Mixtures, Solutions, Pure Chemical Substances, Compounds, and Elements

Matter can be classified into several categories.

All substances are either *pure chemical substances* or *mixtures*. Mixtures can be separated into their component parts through physical means, whereas pure chemical substances require chemical or nuclear reactions to separate them.

Pure chemical substances can be further divided into *elements* or *compounds*.

Mixtures can be either *heterogeneous* or *homogeneous*. Homogeneous mixtures are also called *solutions*.

**Part A**

A sample of tap water consists of water, fluoride ions, calcium ions, and several other dissolved ions. The ions are evenly distributed throughout the water. Which term or terms could be used to describe this sample of tap water?

**Hint A.1 Define the terms**

*Hint not displayed*

**Check all that apply.**

**ANSWER:**

- mixture
- heterogeneous mixture
- homogenous mixture
- solution
- pure chemical substance
- compound
- element

*Correct*

All solutions are homogeneous mixtures, and all homogeneous mixtures are solutions.

**Part B**

A sample is composed completely of gold, absolutely free of impurities. Which term or terms could be used to describe this sample?

**Hint B.1 Define the terms**

*Hint not displayed*

**Check all that apply.**

**ANSWER:**

- mixture
- heterogeneous mixture
- homogenous mixture
- solution
- pure chemical substance
- compound
- element

*Correct*

All elements are pure. If this sample of gold had been impure, we would call it a mixture, not an element.

**Part C**

A blood sample contains several different types of cells, each of which contains different combinations of specific ions and molecules. The cells are suspended in water, and the water also contains many molecules and ions. Which term or terms could be used to describe this sample?

**Hint C.1 Define the terms***Hint not displayed***Check all that apply.****ANSWER:**

- mixture
- heterogeneous mixture
- homogenous mixture
- solution
- pure chemical substance
- compound
- element

*Correct***Part D**

A balloon is filled with pure carbon dioxide. Which term or terms could be used to describe the contents of this balloon?

**Hint D.1 Define the terms***Hint not displayed***Check all that apply.****ANSWER:**

- mixture
- heterogeneous mixture
- homogenous mixture
- solution
- pure chemical substance
- compound
- element

*Correct*

All compounds are pure. If this sample of  $\text{CO}_2$  had been impure, we would call it a mixture, not a compound.

**Dimensional Analysis****Learning Goal:** To understand how to use dimensional analysis to solve problems.

Dimensional analysis is a useful tool for solving problems that involve unit conversions. By carefully tracking units and conversion factors, you can avoid many of the errors commonly encountered in chemistry problems. Dimensional analysis can also help you work through problems when you are not sure where to begin.

Dimensional analysis involves multiplying a given value by a conversion factor. This results in a value in the new units. The conversion factor can be the ratio of any two quantities, as long as the ratio is equal to one.

For example, dimensional analysis could be used to determine the number of nickels in 3432.35 **dollars**.

- To begin, write down the starting value, 3432.35 **dollars**. This can also be written as a fraction:  $\frac{3432.35 \text{ dollars}}{1}$ .
- Next, convert dollars to cents. This conversion involves a simple conversion factor:  $\frac{100 \text{ cents}}{1 \text{ dollar}}$ . Note that the "dollar" unit should appear on the bottom of this conversion factor, since "dollars" appears on the top of the starting value.
- Finally, convert cents to nickels. This conversion also involves a simple conversion factor:  $\frac{1 \text{ nickel}}{5 \text{ cents}}$ . This time "cents" should be on the bottom of the conversion factor, since it was on top of the previous conversion factor.
- Combining these expressions gives us

$$\left(\frac{3432.35 \text{ dollars}}{1}\right) \left(\frac{100 \text{ cents}}{1 \text{ dollar}}\right) \left(\frac{1 \text{ nickel}}{5 \text{ cents}}\right)$$

- Finally, cancel units. Since dollars are divided by dollars, and cents are divided by cents, both of these units can be canceled. Multiplying through gives the final result:

$$\left(\frac{3432.35 \text{ dollars}}{1}\right) \left(\frac{100 \text{ cents}}{1 \text{ dollar}}\right) \left(\frac{1 \text{ nickel}}{5 \text{ cents}}\right) = 68,647 \text{ nickels}$$

You wash dishes for a chemistry laboratory to make extra money for laundry. You earn 6 **dollars/hour**, and each shift lasts 75 **minutes**. Your laundry requires 6 **quarters/load**.

### Part A

How many shifts must you work if you wish to wash 10 **loads** of laundry?

#### Hint A.1 How to approach the problem

*Hint not displayed*

#### Hint A.2 Find the number of quarters required

*Hint not displayed*

#### Hint A.3 Find the number of dollars required

*Hint not displayed*

#### Hint A.4 Find the number of hours you must work

*Hint not displayed*

#### Hint A.5 Find the number of minutes you must work

*Hint not displayed*

Express your answer numerically as an integer.

ANSWER: 2 shifts  
Correct

An important step of any problem solving strategy is to perform a final check to make sure that your answer makes sense. After analyzing the problem, setting up your equation, and completing the calculation you should evaluate your final answer. The magnitude and value of your answer should make physical sense.

### Part B

How many loads of laundry can you wash if you work 3 shifts?

Hint B.1 How to approach the problem

*Hint not displayed*

Express your answer numerically as an integer.

ANSWER: 15 loads  
Correct

### Part C

How many loads of laundry will each shift pay for if the cost per load rises to 8 quarters?

Hint C.1 How to approach the problem

*Hint not displayed*

Hint C.2 Find the number of minutes you work

*Hint not displayed*

Hint C.3 Find the number of hours you work

*Hint not displayed*

Hint C.4 Find the number of dollars earned

*Hint not displayed*

Hint C.5 Find the number of quarters earned

*Hint not displayed*

Express your answer numerically as an integer.

ANSWER: 3 loads  
Correct

Although this particular problem does not actually apply to chemistry, the concept of conversions is extremely important to chemistry as well as to many other subjects.

## Using Conversion Factors

Chemistry is an experimental science in which a consistent system of measurements is used. Scientists throughout the world use the International System of Units (Système International or SI), which is based on the metric system. However, the metric system is not used on an everyday basis in the United States. It is often necessary to convert between the English system, which is used in the United States, and the SI system. One problem with the SI system is the size of the units sometimes turns out to be inconveniently large or small. Therefore it is often necessary to make conversions within the SI system. For this reason, SI units are modified through the use of prefixes when they refer to either larger or smaller quantities.

### Part A

In Europe, gasoline efficiency is measured in **km/L**. If your car's gas mileage is **35.0 mi/gal**, how many liters of gasoline would you need to buy to complete a **142-km** trip in Europe? Use the following conversions:

**1 km = 0.6214 mi** and **1 gal = 3.78 L**.

**Hint A.1 How to approach the problem**

*Hint not displayed*

**Hint A.2 Convert miles to kilometers**

*Hint not displayed*

**Hint A.3 Convert kilometers per gallon to kilometers per liter**

*Hint not displayed*

**Express your answer numerically in liters.**

ANSWER:  L  
*Correct*

A 142-kilometer trip is approximately 90 miles so it would make sense that it would take about 8-16 liters (or 2-4 gallons) of gas to make that trip, depending on the efficiency of your car.

### Part B

While in Europe, if you drive **125 km** per day, how much money would you spend on gas in one week if gas costs **1.10 euros** per liter and your car's gas mileage is **28.0 mi/gal**? Assume that **1 euro = 1.26 dollars**.

**Hint B.1 How to approach the problem**

*Hint not displayed*

**Hint B.2 Convert the efficiency of your car**

*Hint not displayed*

**Hint B.3 Calculate the volume of gas needed in one week**

*Hint not displayed*

**Hint B.4 Calculate the cost of gas in euros**

*Hint not displayed*

Express your answer numerically in dollars.

ANSWER: 102 dollars  
*Correct*

After a fairly heavy week of driving, this would be an appropriate amount of money to spend on gas.

### Part C

A sprinter set a high school record in track and field, running 200.0 m in 20.8 s. What is the average speed of the sprinter in kilometers per hour?

#### Hint C.1 How to approach the problem

The distance the sprinter ran is given in meters and the time is given in seconds. Convert meters to kilometers and seconds to hours and divide the distance by the time to calculate the average speed.

#### Hint C.2 Convert meters to kilometers

The distance the sprinter ran was 200.0 meters. How many kilometers is this?

##### Hint C.2.1 What conversion factor to use

*Hint not displayed*

Express your answer numerically in kilometers.

ANSWER: 200.0 m = 0.2000 km  
*Correct*

#### Hint C.3 Convert seconds to hours

The sprinter completed the race in 20.8 s. Convert that value to hours.

##### Hint C.3.1 How to approach the problem

*Hint not displayed*

Express your answer numerically in hours.

ANSWER: 20.8 s =  $5.78 \times 10^{-3}$  h  
*Correct*

Express your answer numerically in kilometers per hour.

ANSWER: 34.6 km/h  
*Correct*

Approximately 33-35 kilometers per hour is equal to 20-22 miles per hour. This is the top speed that humans can possibly move on foot. Even the best sprinters in the world would not beat this speed by much. Answers that are much higher than this would not be possible by humans. Answers that are much lower than this would be too slow for a top athlete.

### Part D

A specific brand of gourmet chocolate candy contains 7.00 g of dietary fat in each 22.7-g piece. How many kilograms of dietary fat are in a box containing 2.00 lb of candy?

**Hint D.1 How to approach the problem**

*Hint not displayed*

**Hint D.2 Determine the mass in grams of the box of candy**

*Hint not displayed*

**Hint D.3 Determine the number of pieces of candy in the box**

*Hint not displayed*

**Hint D.4 Determine the total amount of dietary fat in grams**

*Hint not displayed*

**Express your answer numerically in kilograms.**

ANSWER: **0.280** kg  
*Correct*

The recommended daily amount of dietary fat (based on a 2000 calories a day diet) is about 67 g (0.067 kg).

## Temperature Scales

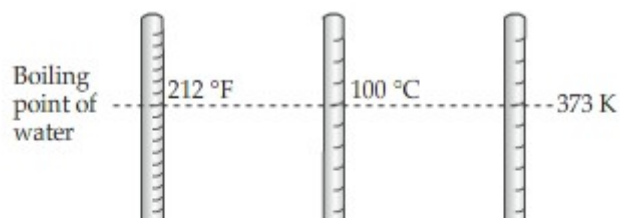
Temperature can be measured using three different scales: Celsius, Fahrenheit, and Kelvin. The Celsius degree ( $^{\circ}\text{C}$ ) is the common unit of temperature, but most people in the United States use the Fahrenheit degree ( $^{\circ}\text{F}$ ). The kelvin ( $\text{K}$ ) is used in science. You can convert from one temperature scale to another by using the conversions

$$T_{\text{C}} = \frac{5^{\circ}\text{C}}{9^{\circ}\text{F}} \times (T_{\text{F}} - 32^{\circ}\text{F})$$

$$T_{\text{F}} = \left( \frac{9^{\circ}\text{F}}{5^{\circ}\text{C}} \times T_{\text{C}} \right) + 32^{\circ}\text{F}$$

$$T_{\text{K}} = T_{\text{C}} + 273.15$$

The boiling and freezing points of water are constants. Water boils at 212  $^{\circ}\text{F}$ , 100  $^{\circ}\text{C}$ , or 373.15  $\text{K}$ . Although these temperatures are equivalent, the scales used to measure them are different. Water freezes at 32  $^{\circ}\text{F}$ , 0  $^{\circ}\text{C}$ , or 273.15  $\text{K}$ . Note that these conversions are based on the fact that water will boil or freeze at a certain temperature regardless of the scale used to measure it.



The average normal human body temperature is 98.6 °F.

### Part A

What is normal body temperature in degrees Celsius?

**Hint A.1 Identify the best formula**

*Hint not displayed*

**Hint A.2 Determine the order of operations for the equation**

*Hint not displayed*

**Express your answer numerically in degrees Celsius.**

ANSWER: 37.0 °C  
*Correct*

Notice that the conversion factor includes the fraction  $\frac{5\text{ }^{\circ}\text{C}}{9\text{ }^{\circ}\text{F}}$ . This indicates that for every change of 5 °C, there is a change of 9 °F. Because a change of 1 Celsius degree is approximately the same as a change of 2 Fahrenheit degrees, you can double the temperature in Celsius and add 30 to quickly estimate a temperature in degrees Fahrenheit from a Celsius measurement. This estimation method is useful for Americans traveling abroad.

### Part B

What is normal body temperature in kelvins?

**Express your answer in kelvins using four significant figures.**

ANSWER: 310.2 K  
*Correct*

### Part C

Rank the size of a change in temperature of one degree Fahrenheit, one degree Celsius, and one kelvin. In other words, if a thermometer were to show that the temperature outside increased by these amounts, which change would feel the largest? If any of the options are the same magnitude, stack them above one another.

**Hint C.1 How to approach the problem**

*Hint not displayed*

**Hint C.2 Determine the number of Fahrenheit degrees between boiling and freezing**

*Hint not displayed*

**Hint C.3 Determine the number of Celsius degrees between boiling and freezing**

*Hint not displayed*

**Hint C.4 Determine the number of kelvins between boiling and freezing**

*Hint not displayed*

**Hint C.5 Compare the size of changes of 1 °C and 1 °F**

*Hint not displayed*

**Hint C.6 Compare the size of changes of 1 K and 1 °C**

*Hint not displayed*

**Rank the sizes of one degree in each scale from largest to smallest. To rank items as equivalent, overlap them.**

**ANSWER:**



[View](#)  
*Correct*

## Rounding

It will be helpful to remember two guidelines about significant figures.

1. After multiplication or division, the answer cannot have more significant figures than any of the original numbers.
2. After addition or subtraction, the answer cannot have more digits to the right of the decimal point than any of the original numbers.

After determining the appropriate number of significant figures, round off your final answer.

1. If the first digit you drop is greater than 5, add 1 to the last digit you keep. You are rounding up.
2. If the first digit you drop is less than 5, do nothing to the digits you keep. You are rounding down.
3. If the digit you drop is 5, and there are no following digits, round down. If there are digits following the 5, round up.

### Part A

A bakery measured the mass of a whole cake as 0.870 **kg**. A customer bought one slice of the cake and measured the mass of the slice as 0.1151 **kg**. What is the mass of the remaining cake, without the one slice?

**Hint A.1 How to approach the problem***Hint not displayed***Hint A.2 Calculate the unrounded mass of remaining cake***Hint not displayed***Hint A.3 Determine the number of digits after the decimal place in the known values***Hint not displayed***Hint A.4 Determine the number of digits after the decimal place in the answer***Hint not displayed*

Express your answer in kilograms using the appropriate number of significant figures.

ANSWER: **0.755** kg  
*Correct*

**Part B**

An unknown object is placed on a balance, which then reads 6.118 g. Its volume is measured to be 3.04 cm<sup>3</sup>. Find the density of this object by dividing mass by volume.

**Hint B.1 How to approach the problem***Hint not displayed***Hint B.2 Calculate the unrounded density***Hint not displayed***Hint B.3 Determine the number of significant figures in the answer***Hint not displayed*

Express your answer in grams per cubic centimeter to the appropriate number of significant figures.

ANSWER: **2.01** g/cm<sup>3</sup>  
*Correct*

**Density Calculations**

Density is an intensive physical property that relates the mass of an object to its volume. Density, which is simply the mass of an object divided by its volume, is expressed in the SI derived unit g/mL for a liquid or g/cm<sup>3</sup> for a solid.

Most substances expand or contract when heated or cooled, so the density values for a substance are temperature dependent..

**Part A**

A particular brand of gasoline has a density of 0.737 g/mL at 25 °C. How many grams of this gasoline would fill a 15.9 gal tank?

**Hint A.1** How to approach the problem

*Hint not displayed*

**Hint A.2** Convert gallons to milliliters

*Hint not displayed*

**Hint A.3** Find an equation for mass

*Hint not displayed*

**Express your answer numerically in grams.**

ANSWER:  $4.43 \times 10^4$  g  
*Correct*

**Part B**

A block of metal has a width of 3.2 cm, a length of 17.1 cm, and height of 4.2 cm. Its mass is 1.1 kg. Calculate the density of the metal.

**Hint B.1** Determine the equation for density

*Hint not displayed*

**Hint B.2** Convert the mass from kilograms to grams

*Hint not displayed*

**Hint B.3** Calculate the volume of the metal

*Hint not displayed*

**Express your answer in grams per cubic centimeter using two significant figures.**

ANSWER: 4.8 g/cm<sup>3</sup>  
*Correct*

The density of this object is greater than that of water (1.0 g/mL) so it would sink in water. Intuitively, this makes sense as the majority of metals sink in water.

### Density of a Regular Solid

By definition,

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Typical units of density are g/mL or g/cm<sup>3</sup>.

$$1 \text{ mL} = 1 \text{ cm}^3$$

**Part A**

The density of iron is 7.87 g/mL. What is the mass of a 3.00 cm × 4.00 cm × 1.00 cm block of iron?

**Hint A.1 Calculate the volume of iron***Hint not displayed*

Express your answer in grams.

ANSWER: mass = **94.4** g  
*Correct*

**Exercise 1.38: Problems by Topic - The Classification and Properties of Matter****Part A**

Classify each of the following as a pure substance or a mixture.

ANSWER:



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*Correct*

**Part B**

If it is a pure substance, classify it as an element or a compound.

- ANSWER:
- Iron is an compound, carbon monoxide is a element.
  - Iron is an element, carbon monoxide is a compound.
  - Both are elements.
  - Both are compounds.

*Correct*

**Part C**

If it is a mixture, classify it as homogeneous or heterogeneous.

- ANSWER:
- Wine is heterogenous, beef stew is homogeneous.
  - Wine is homogeneous, beef stew is heterogeneous.
  - Both are homogeneous.
  - Both are heterogeneous

*Correct*

### Exercise 1.46: Problems by Topic - The Classification and Properties of Matter

#### Part A

Classify each of the following properties as physical or chemical.

ANSWER:



[View](#)

*Correct*

### Exercise 1.48: Problems by Topic - The Classification and Properties of Matter

#### Part A

Classify each of the following changes as physical or chemical.

ANSWER:



[View](#)

*Correct*

### Exercise 1.51: Problems by Topic - Units in Measurement

Perform each of the following temperature conversions.

#### Part A

32 °F to °C (temperature at which water freezes)

ANSWER:

$$T = 0 \text{ } ^\circ\text{C}$$

*Correct*

#### Part B

77 K to °F (temperature of liquid nitrogen)

ANSWER:  $T = -321$  °F  
*Correct*

Part C

– 109 °F to °C (temperature of dry ice)

ANSWER:  $T = -78.3$  °C  
*Correct*

Part D

98.6 °F to K (body temperature)

Express your answer using four significant figures.

ANSWER:  $T = 310.1$  K  
*Correct*

### Exercise 1.66: Problems by Topic - Density

Acetone (nail polish remover) has a density of 0.7857 g/cm<sup>3</sup>.

Part A

What is the mass, in g, of 28.50 mL of acetone?

Express your answer using four significant figures.

ANSWER:  $m = 22.39$  g  
*Correct*

Part B

What is the volume, in mL, of 6.56 g of acetone?

ANSWER:  $V = 8.35$  mL  
*Correct*

### Exercise 1.72: Problems by Topic - The Reliability of a Measurement and Significant Figures

How many significant figures are in each of the following numbers?

Part A

0.1111 s

**ANSWER:**

- 3  
 4  
 5  
 ambiguous

*Correct***Part B**

0.0015 m

**ANSWER:**

- 2  
 4  
 5  
 ambiguous

*Correct***Part C**

108,700 km

**ANSWER:**

- 3  
 4  
 6  
 ambiguous

*Correct***Part D** $3.13000 \times 10^5$  g**ANSWER:**

- 3  
 4  
 6  
 ambiguous

*Correct***Part E**

30,800

**ANSWER:**

- 2  
 3

- 5  
 ambiguous

*Correct*

### Exercise 1.79: Problems by Topic - Significant Figures in Calculations

Perform the following calculations to the correct number of significant figures.

Part A

$$36.9 - 1.877$$

ANSWER: **35.0**  
*Correct*

Part B

$$23.4 + 2.858 + 5.5 + 106.84$$

ANSWER: **138.6**  
*Correct*

Part C

$$22.0 + 56.38 - 5.344$$

ANSWER: **73.0**  
*Correct*

Part D

$$6.10 - 5.532$$

ANSWER: **0.57**  
*Correct*

### Exercise 1.85: Problems by Topic - Unit Conversions

A runner wants to run 11.8 **km**. She knows that her running pace is 7.1 miles per hour.

Part A

How many minutes must she run?

**Express your answer using two significant figures.**

ANSWER:  $t =$ **62** *Correct* **min**

**Exercise 1.94: Problems by Topic - Unit Conversions**

An infant ibuprofen suspension contains 100 mg/5.0mL suspension. The recommended dose is 10 mg/kg body weight.

**Part A**

How many mL of this suspension should be given to an infant weighing 19 lb? (Assume two significant figures.)

Express your answer using two significant figures.

ANSWER:  $V = 4.3$  mL  
*Correct*

**Exercise 1.124: Conceptual Problems**

For each box below, examine the blocks attached to the balances.

**Part A**

Based on their positions and sizes, determine which block is more dense (the dark block or the lighter-colored block), or if the relative densities cannot be determined. (Think carefully about the information being shown.)  
The first picture.



(a)

- ANSWER:
- the dark block is more dense
  - the lighter-colored block is more dense
  - the relative densities cannot be determined

*Correct*

**Part B**

The second picture.



ANSWER:

- the dark block is more dense  
 the lighter-colored block is more dense  
 the relative densities cannot be determined

*Correct*

### Part C

The third picture.



(c)

ANSWER:

- the dark block is more dense  
 the lighter-colored block is more dense  
 the relative densities cannot be determined

*Correct*

### Exercise 1.105: Cumulative Problems

A thief uses a can of sand to replace a solid gold cylinder that sits on a weight-sensitive, alarmed pedestal. The can of sand and the gold cylinder have exactly the same dimensions (length = 22 **cm** and radius = 4.2 **cm** ).

### Part A

Calculate the mass of each cylinder (ignore the mass of the can itself). (density of gold =  $19.3 \text{ g/cm}^3$ , density of sand =  $3.00 \text{ g/cm}^3$ )

**Enter your answers numerically separated by a comma. Express your answer using two significant figures.**

ANSWER:  $m_{\text{gold}}, m_{\text{sand}} = 2.4 \times 10^4, 3700 \text{ g}$   
*Correct*

#### Part B

Did the thief set off the alarm?

ANSWER:  most likely yes  
 most likely no

*Correct*

#### Part C

Explain.

ANSWER: **My Answer:**

#### Score Summary:

Your score on this assignment is 102.7%.

You received 19.47 out of a possible total of 20 points, plus 1.07 points of extra credit.