Answer to Practice Problem 1.1

phosphorus, carbon, bromine, sulfur

This 1.2

vou instinctively identified the element sym
Why are these symbols incorrect for potassiu

Problem 1.2

d is a soft, dull, silver-colored metal. Write the symb
ment lead. A:
symbol f e jewelry
at is the r

Answer to Practice Problem 1.2
(a) Pb

Practice

ns 1.39 and 1.40 at the end of the chap

ls A **compound**, sometimes called a *ch*
s a pure substance composed of two or mo
definite proportions. A compound has pro
m those of its component elements. For exa
e broken down into its component elements
s characteristics are different from both (Fi

his 1.2

instinctively identified the element sy
are these symbols incorrect for potass

oblem 1.2

a soft, dull, silver-colored metal. Write the sy
t lead. A:
mbol
jewe
the r

Answer to Practice Problem 1.2
(b) silver

ctice

1.39 and 1.40 at the end of the ch

A compound, sometimes called a
pure substance composed of two or m

Answer to Practice Problem 1.3

Aluminum can, heterogeneous mixture (metal can with inner plastic liner and paint on the outside). *Stone fountain,* heterogeneous mixture. *Helium balloon,* the helium in the balloon is not a mixture. The helium and balloon together are a heterogeneous mixture. *Pizza,* heterogeneous mixture. *Copper coin,* if made of pure copper, not a mixture. Newer pennies are a heterogeneous mixture with a zinc core and coating of copper. Older pennies are a homogeneous mixture of copper and zinc.

Further Practice

Questions 1.51

he chapter

Answer to Practice Problem 1.4

(a) A

If image E re d) and sulfu

(yellow), wh for sulfur f

Answer to Practice Problem 1.4

(b) SO_3

her Practice

stions 1.51 and 1.52 at the end of the chapter

equence of steps can be summarized as:

$$\text{nt in pounds} = 50.0 \cancel{\text{mg}} \times \frac{1 \cancel{\text{g}}}{1000 \cancel{\text{mg}}} \times \frac{1 \text{ lb}}{453.6 \cancel{\text{g}}} = 1.10$$

sider This 1.5

wouldn't ar nd part of t
ion make se

Answer to Practice Problem 1.5
347,000 g; 347 kg

tice Problem 1.5

and Bill see an aluminum recycling truck pass by on
o class. If there are 765 lb of aluminum in the truck, h
grams are there? How many kilograms? A:

ner Practice:

tions 1.67 and 1.68 at the end of the chapter

STUDENT HOT SPOT

ent data indicate you may struggle with unit

ny ounces is this? A:

Problem 1.6

d Bill saw some balloons outside the bookstore.
of gas inside one of the helium balloons was 4.6
the volume of gas in units of milliliters? In units
ntimeters? In units of gallons (4 qt = 1 gal)? A:

Pract

Answer to Practice Problem 1.6

4.60×10^3 mL; 4.60×10^3 cm^3; 1.22 gal

ns 1.7 apter

The **density** of an ratio of its mass to While mass and depend on the size t or sample, density ensity is an unvarying a substance no matter

A can of diet cola float water, but a can of regu sinks. Suggest a reason How can you use this information to quickly your preferred type of drink from a cooler fill

$$\text{Volume} = 100.0 \cancel{\text{g}} \times \frac{1 \text{ cm}^3}{8.9 \cancel{\text{g}}} = 11 \text{ cm}^3$$

Does the answer make sense? Yes. The density tells us that 8.9 g of copper occupy a volume of 1 cm^3. The mass given, 100.0 g, is over 10 times greater than 8.9 so we would expect it to occupy a volume that is over 10 times greater than 1 cm^3.

Consider This 1.7

What if the 100.0-g piece of metal were gold? Would you expect its volume to be greater or less than 11 cm^3? How much greater or less? A:

Practice Problem 1.7

Solve the following problems.

(a) The density (the volume of 1.00 g of pur

(b) 14-Carat gol als containing 58% gold by f silver and copper. Silver and copper are both less dense than gold. Which of the following could be the mass of 1.00 cm^3 of 14-carat gold: 16.0 g, 19.3 g, or 23.0 g? A:

Answer to Practice Problem 1.7
(a) 0.0518 cm^3

Further Practice:

Questions 1.77 and **1.78** at the end of the chapter

Why do substances have

Water is unique among liquids

$$\text{Volume} = 100.0 \cancel{\text{g}} \times \frac{}{8.9 \cancel{\text{g}}} = 11 \text{ cm}^3$$

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Answer to Practice Problem 1.7
(b) 16.0 g

Further Practice:

Questions 1.77 and **1.78** at the end of the chapter

Why do substances have

Ice Liquid water

Solution:

In ice, the H_2O molecules have more space between them than in liquid water. The total volume occupied by a given number of molecules is greater in ice. Because density is a ratio of mass to volume, the larger volume accounts for the lower density.

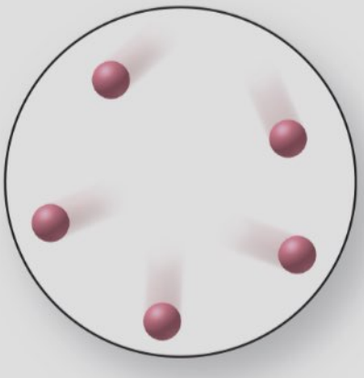
Consider This 1.8

What if hexane, with a density of 0.659 g/cm^3, were carefully added to a glass of ice water? Where would the hexane be relative to the ice and liquid water? A:

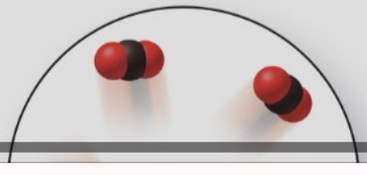
Practice Proble

Answer to Practice Problem 1.8
rises

Helium balloons of oxygen and nitrogen molecules, so we know helium is less dense than air. Look at the molecular-level diagrams of helium and carbon dioxide. Predict whether a helium balloon rises or falls in an atmosphere of carbon dioxide. A:



Helium



To convert degrees Celsius to degrees Fahrenheit, we use the equation:

$$T°\text{F} = 1.8(T°\text{C}) + 32$$

Substituting the temperature in degrees Celsius, we get:

$$T°\text{F} = 1.8(1083) + 32 = 1981°\text{F}$$

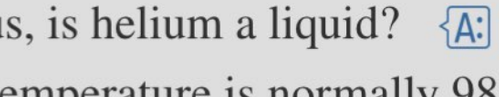
Consider This 1.9

What is the phys

Answer to Practice Problem 1.9
(a) 245.1 K; −18.6°F

Practice Problem 1.9

(a) The boiling point of acetylene is −28.1°C. Below what temperature, in kelvins and degrees Fahrenheit, is acetylene a liquid? 

(b) The boiling point of helium is 4 K. Below what temperature, in degrees Celsius, is helium a liquid? 

(c) Human body temperature is normally 98.6°F. What is this temperature on the Celsius and Kelvin scales? 

Further Practice:

Questions 1.85 and **1.86** at the end of the chapter

hysical Changes

To convert degrees Celsius to degrees Fahrenheit, we use the equation:

$$T°\text{F} = 1.8(T°\text{C}) + 32$$

Substituting the temperature in degrees Celsius, we get:

$$T°\text{F} = 1.8(1083) + 32 = 1981°\text{F}$$

Consider This 1.9

What is the phys

Answer to Practice Problem 1.9
(b) −269°C

Practice Problem 1.9

(a) The boiling point of acetylene is −28.1°C. Below what temperature, in kelvins and degrees Fahrenheit, is acetylene a liquid?

(b) The boiling point of helium is 4 K. Below what temperature, in degrees Celsius, is helium a liquid?

(c) Human body temperature is normally 98.6°F. What is this temperature on the Celsius and Kelvin scales?

Further Practice:

Questions 1.85 and **1.86** at the end of the chapter

We substitute the value of the Celsius temperature into the expression and solve for the temperature in kelvins:

$$T_{\text{K}} = 1083 + 273.15 = 1356 \text{ K}$$

To convert degrees Celsius to degrees Fahrenheit, we use the equation:

$$T^{\circ}\text{F} = 1.8(T^{\circ}\text{C}) + 32$$

Substituting the temperature in degrees Celsius, we get:

$$T^{\circ}\text{F} = 1.8(1083) + 32 = 1981^{\circ}\text{F}$$

Consider This 1.9

What is the phys

Answer to Practice Problem 1.9
(c) 37.0°C; 310.1 K

Practice Problem 1.9

(a) The boiling point of acetylene is −28.1°C. Below what temperature, in kelvins and degrees Fahrenheit, is acetylene a liquid? A:

(b) The boiling point of helium is 4 K. Below what temperature, in degrees Celsius, is helium a liquid? A:

(c) Human body temperature is normally 98.6°F. What is this temperature on the Celsius and Kelvin scales? A:

Further Practice:

Which of the following are physical changes and which are chemical changes?

(a) evaporation
(b) burning methane gas to form carbon dioxide and water
(c) using a magnet to separate metal and plastic paperclips
(d) rusting (the conversion of iron to iron oxide)

Solution:

(a) Evaporation is a physical change because it involves only a change of state.
(b) Burning methane gas is a chemical change because new substances form.
(c) Separating components of a mixture is a physical change.
(d) Rusting is a [illegible] tance forms.

Consider This 1

Answer to Practice Problem 1.10
(a) physical property

Is digesting the pizza Anna and Bill ate for a lunch a chemical or a physical change? A:

Practice Problem 1.10

Page 26

Which of the following are physical properties and which are chemical properties?

(a) boiling point of ethanol A:
(b) ability of propane to burn A:
(c) tendency for silver to tarnish A:
(d) density of aluminum A:

Further Practice:

Questions 1.91 and **1.92** at the end of the chapter

Sometimes simple observation cannot tell us whether a change

Water molecules surround

Which of the following are physical changes and which are chemical changes?

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(d) Rusting is a [illegible] tance forms.

Consider This 1

Answer to Practice Problem 1.10
(b) chemical property

Is digesting the pizza Anna and Bill ate for a lunch a chemical or a physical change? A:

Practice Problem 1.10

Page 26

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Further Practice:

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(c) Separating components of a mixture is a physical change.
(d) Rusting is a tance forms.

Consider This 1

Answer to Practice Problem 1.10
(c) chemical property

Is digesting the pizza Anna and Bill ate for a lunch a chemical or a physical change? A:

Practice Problem 1.10

Page 26

Which of the following are physical properties and which are chemical properties?

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(c) Separating components of a mixture is a physical change.
(d) Rusting is a [illegible] tance forms.

Consider This 1

Answer to Practice Problem 1.10
(d) physical property

Is digesting the pizza Anna and Bill ate for a lunch a chemical or a physical change? A:

Practice Problem 1.10

Page 26

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(b) ability of propane to burn A:
(c) tendency for silver to tarnish A:
(d) density of aluminum A:

Further Practice:

Questions 1.91 and **1.92** at the end of the chapter

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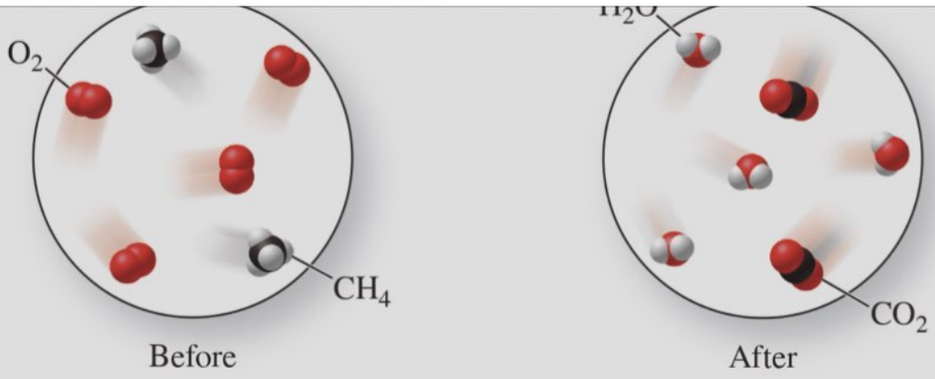
Water molecules surround



Before After

Solution:

The substances after the change have a different composition than the substances before the change. Therefore, this is a chemical change.

Consider This 1

How do atom at elements in the change shown in

Answer to Practice Problem 1.11
physical change

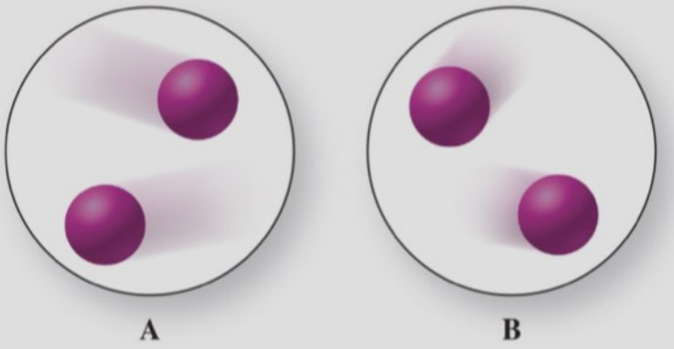
Practice Problem 1.11

Do the following molecular-level images represent a chemical change or a physical change?

Before After

Further Practice:

Questions 1.95 and **1.96** at the end of the chapter



Solution:

The atoms that are moving faster have the greater kinetic energy. Thus, the atoms in A have the greater kinetic energy.

Consider This 1.12

How would the trail lengths have to be changed if the kinetic energy of A decreased and B increased?

Practice Prob

Which of the t er temperature?

Answer to Practice Problem 1.12
the image with atoms moving slower (B)

Further Practice:

Questions 1.103 and **1.104** at the end of the chapter

Electric energy is associated with the passage of electricity, generally through metals. The electric energy from a battery arises from a chemical reaction. The chemical energy stored in the compounds that make up the battery is converted to electric energy. Electric current passed through the filament of a lightbulb causes the metal to glow red and increases the motion of the atoms. This is a conversion of electric energy to kinetic energy. A lightbulb also gives off light energy. Nuclear energy involves both light and heat. Energy is released when one element is converted to another, as in a nuclear reactor or in the Sun, where hydrogen atoms fuse to form helium.

Solution:

Anything that might move in the picture has potential energy. Kinetic energy is evident in the moving people and vehicles.

Consider This 1.13

What are some examples of electric energy in the picture?

Practice Proble

Identify three ad photograph.

Answer to Practice Problem 1.13
light, heat, and chemical energy

Further Practice:

Questions 1.107 and **1.108** at the end of the chapter

All these forms of energy can be converted into one another. For example, the welder at the construction site starts a gasoline engine that runs a generator that makes the electricity the welder uses to join two pieces of metal together. The chemical energy in the gasoline is converted to

Common units of energy are calories, Calories (with a capital C), and joules. The energy input you need per day is about 2000 Calories, 2 million calories, or 8 million joules. We will study ways of measuring energy changes in **Chapter 6**.