29. The following equation can be used to convert Fahrenheit temperature to Celsius temperature.

$$°C = \frac{(°F - 32)}{1.8}$$

Use algebra to change the equation to convert Celsius temperature to Fahrenheit temperature.

31. Classify each pure substance as an element or a compound.
   (a) aluminum
   (b) sulfur
   (c) methane
   (d) acetone

33. Classify each mixture as homogeneous or heterogeneous.
   (a) coffee
   (b) chocolate sundae
   (c) apple juice
   (d) gasoline

35. Classify each substance as a pure substance or a mixture. If it is a pure substance, classify it as an element or a compound. If it is a mixture, classify it as homogeneous or heterogeneous.
   (a) helium gas
   (b) clean air
   (c) rocky road ice cream
   (d) concrete

37. Classify each property as physical or chemical.
   (a) the tendency of silver to tarnish
   (b) the shine of chrome
   (c) the color of gold
   (d) the flammability of propane gas

41. Classify each change as physical or chemical.
   (a) A balloon filled with hydrogen gas explodes upon contact with a spark.
   (b) The liquid propane in a barbecue evaporates away because someone left the valve open.
   (c) The liquid propane in a barbecue ignites upon contact with a spark.
   (d) Copper metal turns green on exposure to air and water.

45. An automobile gasoline tank holds 42 kg of gasoline. When the gasoline burns, 168 kg of oxygen are consumed and carbon dioxide and water are produced. What total combined mass of carbon dioxide and water is produced?

47. Are these data sets on chemical changes consistent with the law of conservation of mass?
   (a) A 7.5-g sample of hydrogen gas completely reacts with 60.0 g of oxygen gas to form 67.5 g of water.
   (b) A 60.5-g sample of gasoline completely reacts with 243 g of oxygen to form 206 g of carbon dioxide and 88 g of water.

49. In a butane lighter, 9.7 g of butane combine with 34.7 g of oxygen to form 29.3 g carbon dioxide and how many grams of water?

51. Perform each conversion.
   (a) 588 cal to joules
   (b) 17.4 J to Calories
   (c) 134 kJ to Calories
   (d) 56.2 Cal to joules

53. Perform each conversion.
   (a) 25 kWh to joules
   (b) 249 cal to Calories
   (c) 113 cal to kilowatt-hours
   (d) 44 kJ to calories

59. An adult eats food whose nutritional energy totals approximately 2.2×10^3 Cal per day. The adult burns 2.0×10^3 Cal per day. How much excess nutritional energy, in kilojoules, does the adult consume per day? If 1 lb of fat is stored by the body for each 14.6×10^3 kJ of excess nutritional energy consumed, how long will it take this person to gain 1 lb?

61. A common type of handwarmer contains iron powder that reacts with oxygen to form an oxide of iron. As soon as the handwarmer is exposed to air, the reaction begins and heat is emitted. Is the reaction between the iron and oxygen exothermic or endothermic? Draw an energy diagram showing the relative energies of the reactants and products in the reaction.

63. Classify each process as exothermic or endothermic.
   (a) gasoline burning in a car
   (b) isopropyl alcohol evaporating from skin
   (c) water condensing as dew during the night

65. Perform each temperature conversion.
   (a) 212 °F to Celsius (temperature of boiling water)
   (b) 77 K to Fahrenheit (temperature of liquid nitrogen)
   (c) 25 °C to kelvins (room temperature)
   (d) 98.6 °F to kelvins (body temperature)

71. The temperature in the South Pole during the Antarctic winter is so cold that planes cannot land or take off, effectively leaving the inhabitants of the South Pole isolated for the winter. The average daily temperature at the South Pole in July is −59.7 °C. Convert this temperature to degrees Fahrenheit.

75. Calculate the amount of heat required to raise the temperature of a 65-g sample of water from 32 °C to 65 °C.

81. An iron nail with a mass of 12 g absorbs 15 J of heat. If the nail was initially at 28 °C, what is its final temperature?

83. Calculate the temperature change that occurs when 248 cal of heat are added to 24 g of water.

85. An unknown metal with a mass of 28 g absorbs 58 J of heat. Its temperature rises from 31.1 °C to 39.9 °C. Calculate the heat capacity of the metal and identify it referring to Table 3.4.

87. When 56 J of heat are added to 11 g of a liquid, its temperature rises from 10.4 °C to 12.7 °C. What is the heat capacity of the liquid?

91. How much energy (in J) is lost when a sample of iron with a mass of 25.7 g cools from 75.0 °C to 22.0 °C?
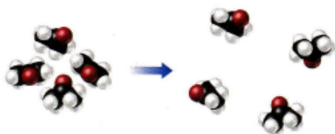
113. Classify each as a pure substance or a mixture.

(a)   (b)

(c)   (d)
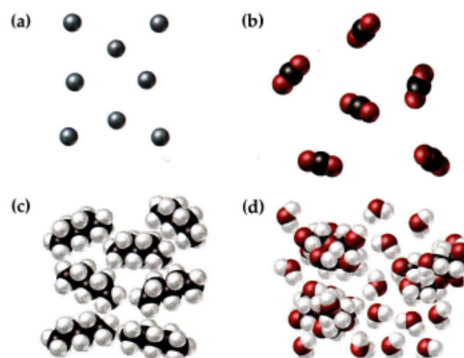
114. Classify each as a pure substance or a mixture. If it is a pure substance, classify it as an element or a compound. If it is a mixture, classify it as homogeneous or heterogeneous.

(a)   (b)

(c)   (d)
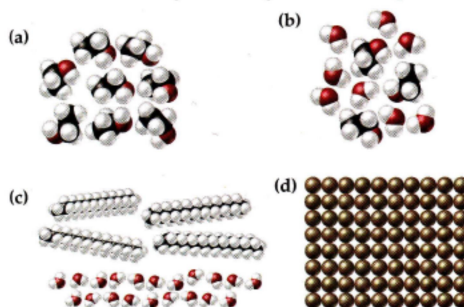
115. This molecular drawing shows images of acetone molecules before and after a change. Was the change chemical or physical?

116. This molecular drawing shows images of methane molecules and oxygen molecules before and after a change. Was the change chemical or physical?