2 MATTER AND CHANGE

Reviewing Content

35. An extensive property depends on the amount of matter; an intensive property depends on the type of matter. Mass and volume are extensive properties. Color and hardness are intensive properties.

36. Answers could include reddish-yellow color, conductor of heat and electricity, malleable, melting point of 1084°C, and boiling point of 2562°C.

37. melting point and boiling point

38. State; both are gases.

39. **a.** solid **b.** liquid
c. gas **d.** liquid
e. gas **f.** liquid

40. A vapor; the term vapor is used to refer to the gaseous state of a substance which normally exists as a liquid or solid at room temperature.

41. The particles in a solid are packed tightly together in an orderly arrangement. Particles in a liquid are in close contact, but not in a orderly arrangement. The particles in a gas are relatively far apart.

42. Chlorine condenses. Mercury, bromine and water freeze.

43. Sharpening a pencil is an irreversible change. Making ice cubes is a reversible change.

44. Heterogeneous mixtures have a non-uniform composition consisting of two or more phases. Homogeneous mixtures have a uniform composition throughout the sample.

45. one; Solutions are homogeneous mixtures with uniform composition throughout.

46. **a.** heterogeneous
b. homogeneous
c. depends on how well the batter is mixed
d. homogeneous

47. The goal is to separate the components of a solution. The solution is boiled to produce a vapor, which is condensed to a liquid. Dissolved solids are left behind.

48. Compounds can be separated by chemical means into simpler substances. Elements cannot.

49. **a.** Hydrogen and oxygen are the elements that make up the compound water.
b. Nitrogen and oxygen are elements present in the mixture air.
c. Sodium and chlorine are elements in the compound table salt.
d. Carbon is an element and water is a compound. They are the final products of heating.

50. **a.** nitrogen, hydrogen
b. potassium, oxygen
c. carbon, hydrogen, oxygen
d. calcium, sulfur

51. In W, the single letter is capitalized. In Hg, the first letter is a capital and the second letter is lowercase.

52. The compound water contains two parts hydrogen to one part oxygen.

53. The composition of the reactants in a chemical change is different from the composition of the products. In a physical change, the chemical composition of a sample doesn't change. When heated, sulfur and iron react and form iron sulfide.

54. **a.** physical
b. chemical (color change)
c. chemical (production of a gas)
d. physical

55. chemical property

56. 18 g of water

Understanding Concepts

57. Mass is an extensive property and depends only on the amount of matter in the sample, not on the composition of the sample.

58. Malleability is an intensive property that depends on the type of matter in a sample.

59. Substances are classified as solids, liquids, or gases according to their state at room temperature, which in this book is 20°C.

60. ethanol

61. neon

62. sulfur

63. sulfur

64. The particles in solids are packed tightly together. The particles in a gas are spaced relatively far apart.

65. kitchen, mixtures; park, mixtures

66. **a.** heterogeneous mixture
b. compound
c. homogeneous mixture
d. heterogeneous mixture

67. **a.** physical **b.** physical
c. physical **d.** physical
e. chemical

68. **a.** Both are elements and solids at room temperature; they are a different color and have different melting points and boiling points.
b. Both are clear liquids at room temperature; distilled water is an element and saltwater is a mixture.
c. Both are white, solid compounds. Sugar is composed of carbon, hydrogen, and oxygen. Salt is composed of sodium and chlorine.

69. In photograph A, bubbles indicate the production of a gas. In photograph B, there is a color change and a precipitate.

70. **a.** Gas is produced.
b. formation of a precipitate
c. color and texture change
d. energy change, odor change

71. A gas can form during a physical change. For example, bubbles form when water boils.

72. The wax appears to disappear because the products of the reaction—carbon dioxide and water vapor—are colorless gases.

Critical Thinking

73. A gas expands to fill any space; a gas has no shape or volume without a container. A solid has a definite shape and volume; a solid doesn't need a container to maintain its shape and volume.

74. The appearance of a substance will change during a change of state, which is a physical change.

75. Gallium (c) will freeze first; mercury (b) will freeze last.

76. Add sufficient water to dissolve all of the sugar. Separate the charcoal and sand from the sugar water by filtration. Large pieces of charcoal could be separated on the basis of color. Small pieces of charcoal could be burned.

77. Iron rusts when it reacts with oxygen in the air to form iron oxide (Fe_2O_3). The mass of the rust is the sum of the mass of the iron and the mass of the oxygen that combined with the iron.

78. Smelling something burning is one possible answer.

79. **a.** Yes; because the graph is a straight line, the proportion of iron to oxygen is a constant, which is true for a compound.
b. No; a point for the values given wouldn't fall on the line. The mass ratio of iron to oxygen is different.

Concept Challenge

80. **a.** oxygen and calcium
b. silicon, aluminum, and iron
c. Different; the second most abundant element in Earth's crust, silicon, is not present in the human body, and the second most abundant element in the human body, carbon, is not among the most abundant elements in Earth's crust. If the elements are different, then the compounds must also be different.

81. **a.** mercury and sulfur
b. Sulfur melts at 113°C and boils at 445°C. Between 113°C and 445°C, it exists as a liquid. Mercury melts at –39°C and boils at 357°C. Between these temperatures, it exists as a liquid.
c. Possibilities include: by color, by boiling point, or in alphabetical order.

82. Many answers are possible. Sample answer: helpful chemical change: cooking food (color change, odor change); harmful chemical change: formation of soap scum (precipitate forms)