Chapter 1--Matter and Measurements

Student: _____

1. An element is a substance that

   A. cannot be decomposed into two or more pure substances.
   B. is composed of two or more different substances.
   C. is a gas at room temperature.
   D. can be separated into two or more pure substances by distillation.
   E. can be separated into two or more substances by chromatography.

2. All of the following statements are true EXCEPT

   A. of the 115 known elements, 91 occur naturally.
   B. an element cannot be broken down into two or more pure substances.
   C. a compound is a substance that contains two or more elements.
   D. a pure compound always contains the same elements in the same mass percentages.
   E. another name for a heterogeneous mixture is a solution.

3. All of the following statements concerning water (H_2O) are false EXCEPT

   A. the percentage of oxygen in H_2O is independent of where the sample is obtained.
   B. H_2O is a heterogeneous mixture.
   C. H_2O is a homogeneous mixture.
   D. H_2O is an element.
   E. H_2O has properties similar to those of the elements hydrogen and oxygen.

4. Which of the following may be used to separate water into hydrogen and oxygen?

   A. filtration
   B. electrolysis
   C. distillation
   D. chromatography
   E. freezing

5. Which of the following is/are likely to form a homogeneous mixture?
   1. milk and ice cream blended together with chocolate syrup
   2. an egg combined with milk and mixed with a whisk
   3. 1 gram table salt combined with 250 mL of water

   A. 1 only
   B. 2 only
   C. 3 only
   D. 1 and 2
   E. 1, 2, and 3

6. Which one of the following is most likely to be a heterogeneous mixture?

A. vinegar (a mixture of acetic acid and water)
B. blood
C. antifreeze (a mixture of water and ethylene glycol)
D. sodium chloride (table salt) dissolved in water
E. the air trapped inside a car tire

7. Which term best describes liquid mercury at room temperature?

A. gas
B. element
C. compound
D. homogeneous mixture
E. heterogeneous mixture

8. Which term best describes rocks, such as granite or marble?

A. element
B. compound
C. distillation
D. homogeneous mixture
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9. All of the following statements are false EXCEPT

A. tin (Sn) is a homogeneous mixture of sulfur (S) and nitrogen (N).
B. table salt is a homogeneous mixture of sodium metal and chlorine gas.
C. the air trapped in a bicycle tire is a homogeneous mixture.
D. sugar dissolves completely in water to give a heterogeneous mixture.
E. water (H_2O) is a homogeneous mixture containing hydrogen and oxygen.

10. Which of the following statements concerning water, H_2O, is/are true?
    1. H_2O is a chemical compound.
    2. H_2O is a homogeneous mixture of hydrogen and oxygen.
    3. The percentage of hydrogen in H_2O is independent of where the water is obtained.

A. 1 only
B. 2 only
C. 3 only
D. 1 and 3
E. 1, 2, and 3

11. Sugar is a compound that dissolves readily in water. Which method is best for separating a mixture of sugar and water?

    A. distillation
    B. light absorption
    C. electrolysis
    D. gas-liquid chromatography
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12. Which method is best for removing the pulp from orange juice?

    A. distillation
    B. light absorption
    C. electrolysis
    D. gas-liquid chromatography
    E. filtration

13. Which one of the following substances is classified as a chemical compound?

    A. He
    B. S_8
    C. Na
    D. NO
    E. N_2

14. Which of the following is the smallest mass?

    A. 1.5×10^8 pg
    B. 1.5×10^6 ng
    C. 1.5×10^3 mg
    D. 1.5×10^{-1} mg
    E. 1.5×10^{-5} g

15. Which of the following is the largest volume?

    A. 5.0×10^2 cm^3
    B. 5.0×10^{-4} L
    C. 5.0×10^3 mL
    D. 5.0×10^{-1} L
    E. 5.0×10^5 mL

16. The radius of a potassium atom is 0.227 nm. What is the radius in millimeters?

    A. 2.27×10^{-9} mm
    B. 2.27×10^{-8} mm
    C. 2.27×10^{-7} mm
    D. 2.27×10^{-6} mm
    E. 2.27×10^{-4} mm

17. Which method is correct for converting kelvin to Celsius?

A.
$$T(°C) = \left(\frac{5°C}{9\,K}\right)T(K) + 32$$

B.
$$T(°C) = \left(\frac{9°C}{5\,K}\right)T(K) + 273.15$$

C.
$$T(°C) = \frac{5°C}{9\,K}\left(T(K) - 273.15\right)$$

D.
$$T(°C) = \frac{1°C}{1\,K}\left(T(K) - 273.15\right)$$

E.
$$T(°C) = \frac{1°C}{1\,K}\left(T(K) + 273.15\right)$$

18. If the temperature of a beaker of water is 65.0°F, what is its temperature in Celsius? (Remember: water melts at 0°C and 32°F; water boils at 100°C and 212°F)

A. 4.11°C
B. 18.3°C
C. 36.1°C
D. 59.4°C
E. 68.1°C

19. If the outdoor temperature is 17.0°C, what is the temperature in Fahrenheit? (Remember: water melts at 0°C and 32°F; water boils at 100°C and 212°F)

A. -1.40°F
B. 30.6°F
C. 41.4°F
D. 62.6°F
E. 74.6°F

20. The boiling point of ammonia is -33.3°C. What is this temperature in kelvin?

A. -306.5 K
B. -33.3 K
C. 239.9 K
D. 306.5 K
E. 331.5 K

21. Water freezes at 0.0°C. What temperature does this correspond to in kelvin?

   A. 173.2 K
   B. 200.2 K
   C. 273.2 K
   D. 300.2 K
   E. 373.2 K

22. Many experiments are conducted at 298 K. What is this temperature in Celsius?

   A. 0°C
   B. 25°C
   C. 55°C
   D. 273°C
   E. 298°C

23. The boiling point for liquid oxygen is 90.0 K. What is the boiling point in Fahrenheit?

   A. -361.4°F
   B. -329.4°F
   C. -297.8°F
   D. -183.0°F
   E. -151.0°F

24. Express 0.00720 in exponential notation.

   A. 7.20×10^{3}
   B. 7.2×10^{-3}
   C. 7.20×10^{-3}
   D. 7.2×10^{3}
   E. 7.2000×10^{-3}

25. Convert 8.900×10^{-8} meters to nanometers and express the answer in standard notation using the correct number of significant figures.

   A. 89 nm
   B. 89.0 nm
   C. 89.00 nm
   D. 8.90 nm
   E. 0.8900 nm

26. How many significant figures are in the following mass: 0.00047800 kg?

   A. 3
   B. 5
   C. 6
   D. 8
   E. 9

27. How many significant figures are in the following volume: 5.00×10^4 mL?

   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

28. What is the correct answer to the following expression: $(205.18 - 197.3) \div 6.226$? Carry out the subtraction operation first.

   A. 1
   B. 1.3
   C. 1.27
   D. 1.266
   E. 1.2657

29. What is the correct answer to the expression below?
   $$1.472 \times 10^{-7} + 4.32 \times 10^{-9} =$$

   A. 2×10^{-7}
   B. 1.5×10^{-7}
   C. 1.52×10^{-7}
   D. 1.515×10^{-7}
   E. 1.5152×10^{-7}

30. What is the correct answer to the following expression?
   $$7.4576 \times 10^{-2} + 4.11 \times 10^{-5} + 6 \times 10^{-4} =$$

   A. $7. \times 10^{-2}$
   B. 7.5×10^{-2}
   C. 7.52×10^{-2}
   D. 7.522×10^{-2}
   E. 7.5217×10^{-2}

31. Round the answer to the following problem to the correct number of significant figures.
   $$(14.0186 \times 0.00458) + (15.0032 \times 0.99542) = 14.99869$$

   A. 15.0
   B. 15.00
   C. 14.999
   D. 14.9987
   E. 14.99869

32. A standard sheet of paper is 8.5 ´ 11 inches. What is the surface area, in cm^2, of one side of a sheet of paper? (2.54 cm = 1.00 inch)

A. 14 cm^2
B. 37 cm^2
C. 94 cm^2
D. 240 cm^2
E. 6.0 ´ 10^2 cm^2

33. The dimensions of a box are 1.2 feet by 0.50 feet by 0.75 feet. Calculate the volume of the box in cubic centimeters. (2.54 cm = 1.00 inch, 12.0 inches = 1.00 foot)

A. 14 cm^3
B. 47 cm^3
C. 306 cm^3
D. 418 cm^3
E. 1.3 ´ 10^4 cm^3

34. How many miles are covered in a 15 km race? (1 mile = 5280 feet, 12 inches = 1 foot, 1 inch = 2.54 cm)

A. 7.1 mile
B. 9.3 mile
C. 11 mile
D. 15 mile
E. 26 mile

35. Atomic dimensions are often reported in Ångstroms (1 Å = 1 ´ 10^{-10} m). If the atomic radius of an aluminum atom is 1.43 Ångstroms, what is its radius in millimeters?

A. 1.43 ´ 10^{-13} mm
B. 1.43 ´ 10^{-7} mm
C. 0.143 mm
D. 14.3 mm
E. 143 mm

36. If the fuel efficiency of an automobile is 32 miles per gallon, what is its fuel efficiency in kilometers per liter? (1 km = 0.621 mile, 1.000 L = 1.057 quarts, 4 quarts = 1 gallon)

A. 5.3 km/L
B. 14 km/L
C. 20 km/L
D. 75 km/L
E. 2.0 ´ 10^2 km/L

37. The volume of a carbon atom is 1.9×10^{-30} m^3. What is the radius of the atom in picometers? The volume of a sphere is $(4/3)\pi r^3$.

   A. 77 pm
   B. 520 pm
   C. 770 pm_2
   D. 3.0×10^2 pm
   E. 52 pm

38. Which of the following observations is/are examples of chemical change?
   1.   Iron (Fe) rusts, forming Fe_2O_3.
   2.   The density of water increases when it changes from a solid to a liquid.
   3.   Sodium chloride melts at 801°C.

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39. All of the following are examples of chemical change EXCEPT

   A. the fermentation of wine.
   B. the tarnishing of silver.
   C. the condensation of steam.
   D. the combustion of butane gas.
   E. the rusting of iron.

40. Which one of the following statements is not a comparison of physical properties?

   A. Mercury and gallium are both liquids at 50°C.
   B. Oxygen is more soluble in water than helium.
   C. The density of gold is greater than the density of silver.
   D. Oxygen and nitrogen are both liquids at -200°C.
   E. Calcium dissolves more quickly than iron in acids.

41. All of the following are examples of an intensive property EXCEPT

   A. solubility.
   B. boiling point.
   C. electrical conductivity of an element.
   D. density.
   E. both boiling point and density.

42. An intensive property of a substance is

   A. independent of the amount present.
   B. dependent on its volume, but not its mass.
   C. not affected by its temperature.
   D. dependent only on its temperature.
   E. dependent only on its mass and volume.

43. An extensive property is

   A. used to identify substances.
   B. independent of amount.
   C. related to density.
   D. dependent upon amount.
   E. observed throughout a substance.

44. 525 mL of water at 25°C (density = 0.997 g/mL) is placed in a container. The water is then cooled to form ice at -10°C (density = 0.917 g/mL). What is the mass and volume of the ice?

   A. 523 g and 525 mL
   B. 523 g and 571 mL
   C. 527 g and 525 mL
   D. 527 g and 571 mL
   E. not enough information given to solve the problem

45. If the density of nitrogen in air is 0.87 g/L, what mass (in kg) of nitrogen is contained in a room with dimensions of 4.0 m ´ 3.5 m ´ 2.4 m?

   A. 29 kg
   B. 39 kg
   C. 2.6×10^{-2} kg
   D. 2.9×10^{4} kg
   E. 26 kg

46. A solid with a mass of 19.3 g is added to a graduated cylinder filled with water to the 25.0 mL mark. After the solid sinks to the bottom, the water level is at 35.8 mL. What is the density of the solid?

   A. 0.539 g/mL
   B. 0.560 g/mL
   C. 1.79 g/mL
   D. 2.19 g/mL
   E. 8.50 g/mL

47. A barometer is filled with a cylindrical column of mercury that is 76.0 cm high and 1.000 cm in diameter. If the density of mercury is 13.53 g/cm^3, what is the mass of mercury in the column?

   A. 0.227 g
   B. 4.41 g
   C. 808 g
   D. 1.03×10^3 g
   E. 3.23×10^3 g

48. Calcium carbonate, or limestone, is relatively insoluble in water. At 25°C, only 5.8 mg will dissolve in 1.0 liter of water. What volume of water is needed to dissolve 5.0 g of calcium carbonate?

   A. 4.6×10^{-3} L
   B. 3.0×10^{-2} L
   C. 1.4×10^2 L
   D. 3.4×10^2 L
   E. 8.6×10^2 L

49. At 0°C, 35.7 g of sodium chloride (NaCl) will dissolve in 1.00×10^2 mL of water. What mass of sodium chloride will dissolve in 7.75 L of water (at 0°C)?

   A. 4.61 g
   B. 4.61×10^1 g
   C. 7.75×10^1 g
   D. 2.17×10^2 g
   E. 2.77×10^3 g

50. At what point is the temperature in °C twice that of the temperature in °F?

   A. -40.0°C
   B. -32.4°C
   C. -24.6°C
   D. -16.2°C
   E. -8.88°C

Chapter 1--Matter and Measurements Key

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10.   Which of the following statements concerning water, H_2O, is/are true?
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     D. 2.9×10^{4} kg
     E. 26 kg

46. A solid with a mass of 19.3 g is added to a graduated cylinder filled with water to the 25.0 mL mark. After the solid sinks to the bottom, the water level is at 35.8 mL. What is the density of the solid?

     A. 0.539 g/mL
     B. 0.560 g/mL
     C. 1.79 g/mL
     D. 2.19 g/mL
     E. 8.50 g/mL

47. A barometer is filled with a cylindrical column of mercury that is 76.0 cm high and 1.000 cm in diameter. If the density of mercury is 13.53 g/cm^3, what is the mass of mercury in the column?

   A. 0.227 g
   B. 4.41 g
   C. 808 g
   D. 1.03 $\times$ 10^3 g
   E. 3.23 $\times$ 10^3 g

48. Calcium carbonate, or limestone, is relatively insoluble in water. At 25°C, only 5.8 mg will dissolve in 1.0 liter of water. What volume of water is needed to dissolve 5.0 g of calcium carbonate?

   A. 4.6 $\times$ 10^{-3} L
   B. 3.0 $\times$ 10^{-2} L
   C. 1.4 $\times$ 10^2 L
   D. 3.4 $\times$ 10^2 L
   E. 8.6 $\times$ 10^2 L

49. At 0°C, 35.7 g of sodium chloride (NaCl) will dissolve in 1.00 $\times$ 10^2 mL of water. What mass of sodium chloride will dissolve in 7.75 L of water (at 0°C)?

   A. 4.61 g
   B. 4.61 $\times$ 10^1 g
   C. 7.75 $\times$ 10^1 g
   D. 2.17 $\times$ 10^2 g
   E. 2.77 $\times$ 10^3 g

50. At what point is the temperature in °C twice that of the temperature in °F?

   A. -40.0°C
   B. -32.4°C
   C. -24.6°C
   D. -16.2°C
   E. -8.88°C