

17. $4.3 \times 10^2 \mu\text{g}$
 18. 4.26 bottles
 19. $2.4 \times 10^5 \text{ mg}$
 20. $3.8 \times 10^7 \text{ beats/year}$
 21. 2.42 kg
 22. 11.6 days
 23. a. $8.0 \times 10^{-5} \text{ cm}$ b. $8.0 \times 10^{-1} \mu\text{m}$
 c. $8.0 \times 10^{-6} \text{ dm}$ d. $8.0 \times 10^{-4} \text{ mm}$
 24. 0.43 s
 25. $2.50 \times 10^3 \text{ kg}$
 26. 26 m
 27. 4 days
 28. 3 capsules/dose
 29. a. $1.03 \times 10^3 \text{ packs}$ b. 1.41 years
 30. a. 18.0 g b. \$31.50
 31. 52.8 cm^3 sodium
 32. $4.95 \times 10^3 \text{ kg}$
 33. 3.93 kg
 34. 71.5 kg of air
 35. a. $1 \times 10^6 \text{ cm}^3$ b. $1 \times 10^3 \text{ cm}^3$
 c. $5 \times 10^{-21} \text{ cm}^3$ d. $2 \times 10^{12} \text{ cm}^3$

Chapter 4

36. a. not equal b. equal
 c. equal d. not equal
 37. a. 23 protons, 23, electrons, 28 neutrons
 b. 13 protons, 13 electrons, 14 neutrons
 c. 50 protons, 50 electrons, 70 neutrons
 d. 72 protons, 72 electrons, 106 neutrons

17. Mites are small eight-legged “bugs” in the same family as spiders. A particularly small mite has a mass of 0.0043 dg. What is the mass of this mite expressed in micrograms?
 18. In the United States, a typical can of soda holds 355 mL. How many 2.00-L bottles could be filled from a 24-can case of soda?
 19. You are going to carry out a chemical reaction in which you need 16 g of oxygen for every 7.0 g of nitrogen that will be used. If you have 0.554 kg of oxygen, how many milligrams of nitrogen do you need?
 20. If your heart beats at an average rate of 72 times per minute, how many times will your heart beat each year?
 21. Four empty beakers weigh a total of 1.84 kg. Each beaker when full holds 0.75 kg of water. How much do two full beakers of water weigh?
 22. How many days would it take you to count a million pennies if you could count one penny each second? Express the answer to 3 significant figures.
 23. A soap bubble film is $8.0 \times 10^2 \text{ nm}$ thick. Express this thickness in the following units:
 a. centimeters c. decimeters
 b. micrometers d. millimeters
 24. The pitcher’s mound on a regulation baseball field is 60 feet 6 inches from home plate. How many seconds does it take a 96 mph fastball to reach home plate? ($5280 \text{ ft} = 1 \text{ mile}$)
 25. Gemstones such as diamonds are measured in carats, where 1 carat = 2.00 dg. How many kilograms of diamonds were produced if 12.5 million carats of diamonds were mined in a recent year?
 26. How many meters does a car moving at 95 km/hour travel in 1.0 second?
 27. A milliliter of water is equal to 20 drops of water. If water is dripping from a faucet at the rate of 7 drops per minute, how many days will it take to completely fill a 2.00-L soda bottle?
 28. A prescription for a certain drug calls for a dose of 0.200 mg/kg of body weight, four times a day. The drug is packaged in capsules of 5 mg. How many capsules per dose should be given to a patient who weighs 75 kg?
 29. A certain low-tar cigarette contains 11.0 mg of tar per cigarette.
 a. If all the tar gets into the lungs, how many packs of cigarettes (20 cigarettes per pack) would have to be smoked to produce 0.500 lb of tar? ($454 \text{ g} = 1 \text{ lb}$)
 b. If a person smoked two packs per day, how many years would it take to accumulate 0.500 lb of tar?
 30. A chemist needs 25.0 mL of a liquid compound.
 a. What mass of the compound is necessary if the density is 0.718 g/cm^3 ?
 b. If the compound costs \$1.75/gram, what is the cost of this amount of the compound?
 31. What volume of sodium has the same mass as 22.0 cm^3 of silicon? The density of sodium is 0.97 g/cm^3 ; the density of silicon is 2.33 g/cm^3 .
 32. What is the mass, in kilograms, of a block of platinum that measures 23.0 cm by 78.4 cm by 122 cm? The density of platinum is 22.5 g/cm^3 .
 33. Sulfuric acid sold for laboratory use consists of 96.7% sulfuric acid, H_2SO_4 , by mass. The density of the solution is 1.845 g/cm^3 . Compute the number of kilograms of H_2SO_4 in a 2.20-L bottle of laboratory sulfuric acid.
 34. How many kilograms of dry air are in a room that measures 15.0 ft by 18.0 ft by 8.00 ft? Use an average density of air of 1.168 g/L . There are 30.48 cm in one foot.
 35. Calculate the number of cubic centimeters in each of the following:
 a. 1 m^3 c. 5 nm^3
 b. 1 dm^3 d. $2 \times 10^{-3} \text{ km}^3$

Chapter 4

36. In which of these atom(s) is the number of protons equal to the number of neutrons?
 a. germanium-72 c. silicon-28
 b. calcium-40 d. hydrogen-1
 37. Give the total number of subatomic particles (protons, electrons, and neutrons) in each atom.
 a. vanadium-51 c. tin-120
 b. aluminum-27 d. hafnium-178