CHAPTER REVIEW

For more practice, go to the Problem Bank in Appendix D.

Scientific Method

SECTION 1 REVIEW

1. How does quantitative information differ from qualitative information?
2. What is a hypothesis?
3. a. What is a model in the scientific sense?
   b. How does a model differ from a theory?

Units of Measurement

SECTION 2 REVIEW

4. Why is it important for a measurement system to have an international standard?
5. How does a quantity differ from a unit? Use two examples to explain the difference.
6. List the seven SI base units and the quantities they represent.
7. What is the numerical equivalent of each of the following SI prefixes?
   a. kilo-
   b. centi-
   c. mega-
   d. micro-
   e. milli-
8. Identify the SI unit that would be most appropriate for expressing the length of the following.
   a. width of a gymnasium
   b. length of a finger
   c. distance between your town and the closest border of the next state
   d. length of a bacterial cell
9. Identify the SI unit that would be most appropriate for measuring the mass of each of the following objects.
   a. table
   b. coin
   c. a 250 mL beaker
10. Explain why the second is not defined by the length of the day.
11. a. What is a derived unit?
    b. What is the SI-derived unit for area?
12. a. List two SI-derived units for volume.
    b. List two non-SI units for volume, and explain how they relate to the cubic centimeter.
13. a. Why are the units used that are to express the densities of gases different from those used to express the densities of solids or liquids?
    b. Name two units for density.
    c. Why is the temperature at which density is measured usually specified?
14. a. Which of the solids listed in **Table 4** will float on water?
    b. Which of the liquids will sink in milk?
15. a. Define *conversion factor.*
    b. Explain how conversion factors are used.

PRACTICE PROBLEMS

16. What is the volume, in cubic meters, of a rectangular solid that is 0.25 m long, 6.1 m wide, and 4.9 m high?
17. Find the density of a material, given that a 5.03 g sample occupies 3.24 mL. (Hint: See Sample Problem A.)
18. What is the mass of a sample of material that has a volume of 55.1 cm^3 and a density of 6.72 g/cm^3?
19. A sample of a substance that has a density of 0.824 g/mL has a mass of 0.451 g. Calculate the volume of the sample.
20. How many grams are in 882 µg? (Hint: See Sample Problem B.)
21. Calculate the number of milliliters in 0.603 L.
22. The density of gold is 19.3 g/cm^3.
    a. What is the volume, in cubic centimeters, of a sample of gold that has a mass of 0.715 kg?
    b. If this sample of gold is a cube, what is the length of each edge in centimeters?
23. a. Find the number of kilometers in 92.25 m.
    b. Convert the answer in kilometers to centimeters.

Using Scientific Measurements

SECTION 3 REVIEW

24. Compare accuracy and precision.
25. a. Write the equation that is used to calculate percentage error.

b. Under what condition will percentage error be negative?

26. How is the average for a set of values calculated?

27. What is meant by a mass measurement expressed in this form: 4.6 g ± 0.2 g?

28. Suppose a graduated cylinder were not correctly calibrated. How would this affect the results of a measurement? How would it affect the results of a calculation using this measurement?

29. Round each of the following measurements to the number of significant figures indicated.
a. 67.029 g to three significant figures
b. 0.15 L to one significant figure
c. 52.8005 mg to five significant figures
d. 3.174 97 mol to three significant figures

30. State the rules governing the number of significant figures that result from each of the following operations.
a. addition and subtraction
b. multiplication and division

31. What is the general form for writing numbers in scientific notation?

32. a. By using x and y, state the general equation for quantities that are directly proportional.
b. For two directly proportional quantities, what happens to one variable when the other variable increases?

33. a. State the general equation for quantities, x and y, that are inversely proportional.
b. For two inversely proportional quantities, what happens to one variable when the other increases?

34. Arrange in the correct order the following four basic steps for finding the solution to a problem: compute, plan, evaluate, and analyze.

PRACTICE PROBLEMS

35. A student measures the mass of a sample as 9.67 g. Calculate the percentage error, given that the correct mass is 9.82 g. (Hint: See Sample Problem C.)

36. A handbook gives the density of calcium as 1.54 g/cm^3. Based on lab measurements, what is the percentage error of a density calculation of 1.25 g/cm^3?

37. What is the percentage error of a length measurement of 0.229 cm if the correct value is 0.225 cm?

38. How many significant figures are in each of the following measurements? (Hint: See Sample Problem D.)
a. 0.4004 mL
b. 6000 g
c. 1.000 30 km
d. 400. mm

39. Calculate the sum of 6.078 g and 0.3329 g.

40. Subtract 7.11 cm from 8.2 cm. (Hint: See Sample Problem E.)

41. What is the product of 0.8102 m and 3.44 m?

42. Divide 94.20 g by 3.167 22 mL.

43. Write the following numbers in scientific notation.
a. 0.000 673 0
b. 50 000.0
c. 0.000 003 010

44. The following numbers are in scientific notation. Write them in ordinary notation.
a. 7.050×10^3 g
b. $4.000\ 05 \times 10^7$ mg
c. $2.350\ 0 \times 10^4$ mL

45. Perform the following operation. Express the answer in scientific notation and with the correct number of significant figures.
$0.002115\text{m} \times 0.0000405\text{m}$

46. A sample of a certain material has a mass of 2.03×10^{-3} g. Calculate the volume of the sample, given that the density is 9.133×10^{-1} g/cm^3. Use the four-step method to solve the problem. (Hint: See Sample Problem F.)

MIXED REVIEW

47. A man finds that he has a mass of 100.6 kg. He goes on a diet, and several months later he finds that he has a mass of 96.4 kg. Express each number in scientific notation, and calculate the number of kilograms the man has lost by dieting.

48. A large office building is 1.07×10^2 m long, 31 m wide, and 4.25×10^2 m high. What is its volume?

49. An object has a mass of 57.6 g. Find the object's density, given that its volume is 40.25 cm^3.

50. A lab worker measures the mass of some sucrose as 0.947 mg. Convert that quantity to grams and to kilograms.

51. A student calculates the density of iron as 6.80 g/cm^3 by using lab data for mass and volume. A handbook reveals that the correct value is 7.86 g/cm^3. What is the percentage error?

USING THE HANDBOOK

52. Find the table of properties for Group 1 elements in the *Elements Handbook*. Calculate the volume of a single atom of each element listed in the table by using the equation for the volume of a sphere.

$$\frac{4}{3}\pi \cdot r^3$$

53. Use the radius of a sodium atom from the *Elements Handbook* to calculate the number of sodium atoms in a row 5.00 cm long. Assume that each sodium atom touches the ones next to it.

54. a. A block of sodium that has the measurements 3.00 cm × 5.00 cm × 5.00 cm has a mass of 75.5 g. Calculate the density of sodium.

b. Compare your calculated density with the value in the properties table for Group 1 elements. Calculate the percentage error for your density determination.

RESEARCH & WRITING

55. How does the metric system, which was once a standard for measurement, differ from SI? Why was it necessary for the United States to change to SI?

56. What are ISO 9000 standards? How do they affect industry on an international level?

ALTERNATIVE ASSESSMENT

57. **Performance** Obtain three metal samples from your teacher. Determine the mass and volume of each sample. Calculate the density of each metal from your measurement data. (Hint: Consider using the water displacement technique to measure the volume of your samples.)

58. Use the data from the Nutrition Facts label below to answer the following questions:

a. Use the data given on the label for grams of fat and Calories from fat to construct a conversion factor that has the units Calories per gram.

b. Calculate the mass in kilograms for 20 servings of the food.

c. Calculate the mass of protein in micrograms for one serving of the food.

d. What is the correct number of significant figures for the answer in item a? Why?

Nutrition Facts

Serving Size ¾ cup (30g)
Servings Per Container About 14

Amount Per Serving	Corn Crunch	with ½ cup skim milk
Calories	120	160
Calories from Fat	15	20
		% **Daily Value****
Total Fat 2g*	**3**%	**3**%
Saturated Fat 0g	**0**%	**0**%
Cholesterol 0mg	**0**%	**1**%
Sodium 160mg	**7**%	**9**%
Potassium 65mg	**2**%	**8**%
Total Carbohydrate 25g	**8**%	**10**%
Dietary Fiber 3g		
Sugars 3g		
Other Carbohydrate 11g		
Protein 2g		

*Amount in Cereal. A serving of cereal plus skim milk provides 2g fat, less 5mg cholesterol, 220mg sodium, 270mg potassium, 31g carbohydrate (19g sugars) and 6g protein.

**Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Potassium		3,500mg	3,500mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g