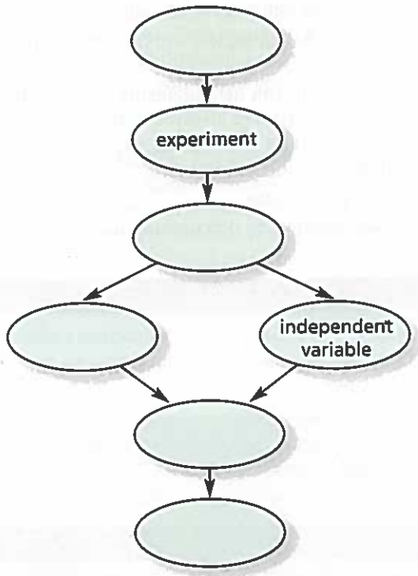
Chapter 1

Assessment

Concept Mapping

30. Complete the following concept map using the following terms: *hypothesis, graph, mathematical model, dependent variable, measurement.*



Mastering Concepts

31. Describe a scientific method. (1.1)

32. Why is mathematics important to science? (1.1)

33. What is the SI system? (1.1)

34. How are base units and derived units related? (1.1)

35. Suppose your lab partner recorded a measurement as 100 g. (1.1)
- **a.** Why is it difficult to tell the number of significant digits in this measurement?
- **b.** How can the number of significant digits in such a number be made clear?

36. Give the name for each of the following multiples of the meter. (1.1)

a. $\frac{1}{100}$ m **b.** $\frac{1}{1000}$ m **c.** 1000 m

37. To convert 1.8 h to minutes, by what conversion factor should you multiply? (1.1)

38. Solve each problem. Give the correct number of significant digits in the answers. (1.1)
- **a.** 4.667×10^{4} g + 3.02×10^{5} g
- **b.** $(1.70\times10^{2}\ \text{J}) \div (5.922\times10^{-4}\ \text{cm}^3)$

39. What determines the precision of a measurement? (1.2)

40. How does the last digit differ from the other digits in a measurement? (1.2)

41. A car's odometer measures the distance from home to school as 3.9 km. Using string on a map, you find the distance to be 4.2 km. Which answer do you think is more accurate? What does *accurate* mean? (1.2)

42. How do you find the slope of a linear graph? (1.3)

43. For a driver, the time between seeing a stoplight and stepping on the brakes is called reaction time. The distance traveled during this time is the reaction distance. Reaction distance for a given driver and vehicle depends linearly on speed. (1.3)
- **a.** Would the graph of reaction distance versus speed have a positive or a negative slope?
- **b.** A driver who is distracted has a longer reaction time than a driver who is not. Would the graph of reaction distance versus speed for a distracted driver have a larger or smaller slope than for a normal driver? Explain.

44. During a laboratory experiment, the temperature of the gas in a balloon is varied and the volume of the balloon is measured. Which quantity is the independent variable? Which quantity is the dependent variable? (1.3)

45. What type of relationship is shown in **Figure 1-20?** Give the general equation for this type of relation. (1.3)

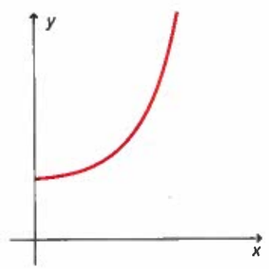


Figure 1-20

46. Given the equation $F = mv^2/R$, what relationship exists between each of the following? (1.3)
- **a.** F and R
- **b.** F and m
- **c.** F and v

 For more problems, go to Additional Problems, Appendix B.

Applying Concepts

47. **Figure 1-21** gives the height above the ground of a ball that is thrown upward from the roof of a building, for the first 1.5 s of its trajectory. What is the ball's height at $t = 0$? Predict the ball's height at $t = 2$ s and at $t = 5$ s.

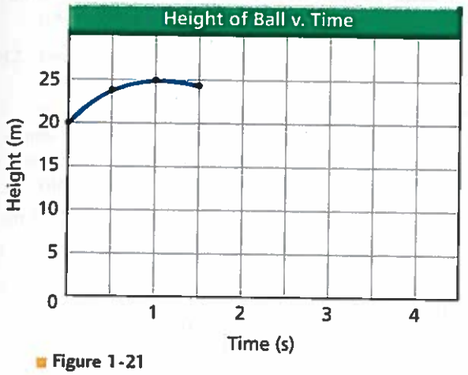


Figure 1-21

48. Is a scientific method one set of clearly defined steps? Support your answer.

49. Explain the difference between a scientific theory and a scientific law.

50. **Density** The density of a substance is its mass per unit volume.
- **a.** Give a possible metric unit for density.
- **b.** Is the unit for density a base unit or a derived unit?

51. What metric unit would you use to measure each of the following?
- **a.** the width of your hand
- **b.** the thickness of a book cover
- **c.** the height of your classroom
- **d.** the distance from your home to your classroom

52. **Size** Make a chart of sizes of objects. Lengths should range from less than 1 mm to several kilometers. Samples might include the size of a cell, the distance light travels in 1 s, and the height of a room.

53. **Time** Make a chart of time intervals. Sample intervals might include the time between heartbeats, the time between presidential elections, the average lifetime of a human, and the age of the United States. Find as many very short and very long examples as you can.

54. **Speed of Light** Two students measure the speed of light. One obtains $(3.001 \pm 0.001)\times10^{8}$ m/s; the other obtains $(2.999 \pm 0.006)\times10^{8}$ m/s.
- **a.** Which is more precise?
- **b.** Which is more accurate? (You can find the speed of light in the back of this textbook.)

55. You measure the dimensions of a desk as 132 cm, 83 cm, and 76 cm. The sum of these measures is 291 cm, while the product is 8.3×10^{5} cm^3. Explain how the significant digits were determined in each case.

56. **Money** Suppose you receive \$5.00 at the beginning of a week and spend \$1.00 each day for lunch. You prepare a graph of the amount you have left at the end of each day for one week. Would the slope of this graph be positive, zero, or negative? Why?

57. Data are plotted on a graph, and the value on the y-axis is the same for each value of the independent variable. What is the slope? Why? How does y depend on x?

58. **Driving** The graph of braking distance versus car speed is part of a parabola. Thus, the equation is written $d = av^2 + bv + c$. The distance, d, has units in meters, and velocity, v, has units in meters/second. How could you find the units of a, b, and c? What would they be?

59. How long is the leaf in **Figure 1-22?** Include the uncertainty in your measurement.

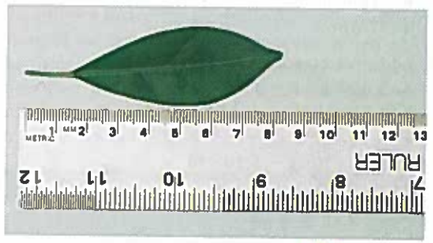


Figure 1-22

60. The masses of two metal blocks are measured. Block A has a mass of 8.45 g and block B has a mass of 45.87 g.
- **a.** How many significant digits are expressed in these measurements?
- **b.** What is the total mass of block A plus block B?
- **c.** What is the number of significant digits for the total mass?
- **d.** Why is the number of significant digits different for the total mass and the individual masses?

61. **History** Aristotle said that the speed of a falling object varies inversely with the density of the medium through which it falls.
- **a.** According to Aristotle, would a rock fall faster in water (density 1000 kg/m^3), or in air (density 1 kg/m^3)?
- **b.** How fast would a rock fall in a vacuum? Based on this, why would Aristotle say that there could be no such thing as a vacuum?

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