Chapter 2 - Scientific Measurements

Text Problems: 3, 5, 7, 9, 13, 15, 21, 23, 29, 35, 39, 41, 47, 51, 57, 65, 69, 71, 75, 91, 93

3. (a) 10.0 cm and (d) 10.5 cm each have an uncertainty of ± 0.1 cm.

5. (c) 75.22 g is the only mass with an uncertainty of ± 0.01 g.

7. (b) 25.0 mL and (c) 25.5 mL each have an uncertainty of ± 0.5 mL.

Section 2.2 *Significant Digits*

9.

	Measurement	Significant Digits
(a)	0.05 cm	1 significant digit
(b)	0.50 cm	2 significant digits
(c)	25.0 cm	3 significant digits
(d)	20.50 cm	4 significant digits

13.

	Measurement	Significant Digits
(a)	1.050×10^2 cm	4 significant digits
(b)	2×10^3 cm	1 significant digit
(c)	3.00×10^{-4} cm	3 significant digits
(d)	5.0×10^{-5} cm	2 significant digits

15.

	Example	Rounded Off
(a)	10.25	10.3
(b)	10.20	10.2
(c)	0.01029	0.0103
(d)	10,248	10,200

21. (a) 242.167 g – 175 g = 67.167 g *rounds to* 67 g
(b) 27.55 g – 14.545 g = 13.005 g *rounds to* 13.01 g

Section 2.5 *Multiplying and Dividing Measurements*

23. (a) 3.65 cm × 2.10 cm = 7.665 cm^2 *rounds to* 7.67 cm^2
(b) 8.75 cm × 1.15 cm = 10.0625 cm^2 *rounds to* 10.1 cm^2
(c) 16.5 cm × 1.7 cm = 28.05 cm^2 *rounds to* 28 cm^2
(d) 21.1 cm × 20 cm = 422 cm^2 *rounds to* 400 cm^2

29. (a) $2 \times 2 \times 2 = 2^3$

(b) $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = (\frac{1}{2})^3 = 2^{-3}$

35.

	Scientific Notation	Ordinary Number
(a)	1×10^1	10
(b)	1×10^{-1}	0.1

39. 2.69×10^{22} helium atoms

41. 3.35×10^{-23} g/neon atom

47. (a) 1 mile = 5280 feet is an exact equivalent;
(b) 1 mile = 1.61 kilometers is an approximate equivalent because it relates two different systems of measurement (English and metric).

51. (a) 1 mile = 5280 feet has an infinite number of significant digits because it is an exact equivalent;
(b) 1 mile = 1.61 kilometers has three significant digits because it is an approximate equivalent.

57. $0.750 \cancel{\text{carat}} \times \frac{0.200 \text{ gram}}{1 \cancel{\text{carat}}} = 0.150 \text{ grams}$

65. $1.00 \cancel{\text{hour}} \times \frac{60 \cancel{\text{minutes}}}{1 \cancel{\text{hour}}} \times \frac{60 \cancel{\text{seconds}}}{1 \cancel{\text{minute}}} \times \frac{3.00 \times 10^8 \text{ m}}{1 \cancel{\text{second}}} = 1.08 \times 10^{12} \text{ m}$

69. 255 mL ethanol + 375 mL water = 630 mL = 6.30×10^2 mL solution

Note: Since 630 mL represents two significant digits, we must express the total as 6.30×10^2 mL.

$\frac{255 \cancel{\text{mL}}}{6.30 \times 10^2 \cancel{\text{mL}}} \times 100\% = 40.5\%$ of solution is ethanol

71. $15.0 \cancel{\text{g oxygen}} \times \frac{100 \text{ g water}}{88.8 \cancel{\text{g oxygen}}} = 16.9 \text{ g water}$

75. Mass of coin = 3.051 g (copper and zinc)
Mass of zinc = 0.153 g
Mass of copper = 3.051 g – 0.153 g = 2.898 g

Percent of copper: $\frac{2.898\ \cancel{g}}{3.051\ \cancel{g}} \times 100\% = 94.99\%$ copper

91. A+: $\frac{18,825 \text{ patients}}{55,368 \text{ patients}} \times 100\% = 34.0\%$ A+ blood type

Note: This is not a measurement; thus, significant digits do not apply.

93. $1\ \cancel{\text{pound}} \times \frac{16\ \cancel{\text{ounces}}}{1\ \cancel{\text{pound}}} \times \frac{28.4 \text{ grams}}{1\ \cancel{\text{ounce}}} = 454$ grams (feathers)