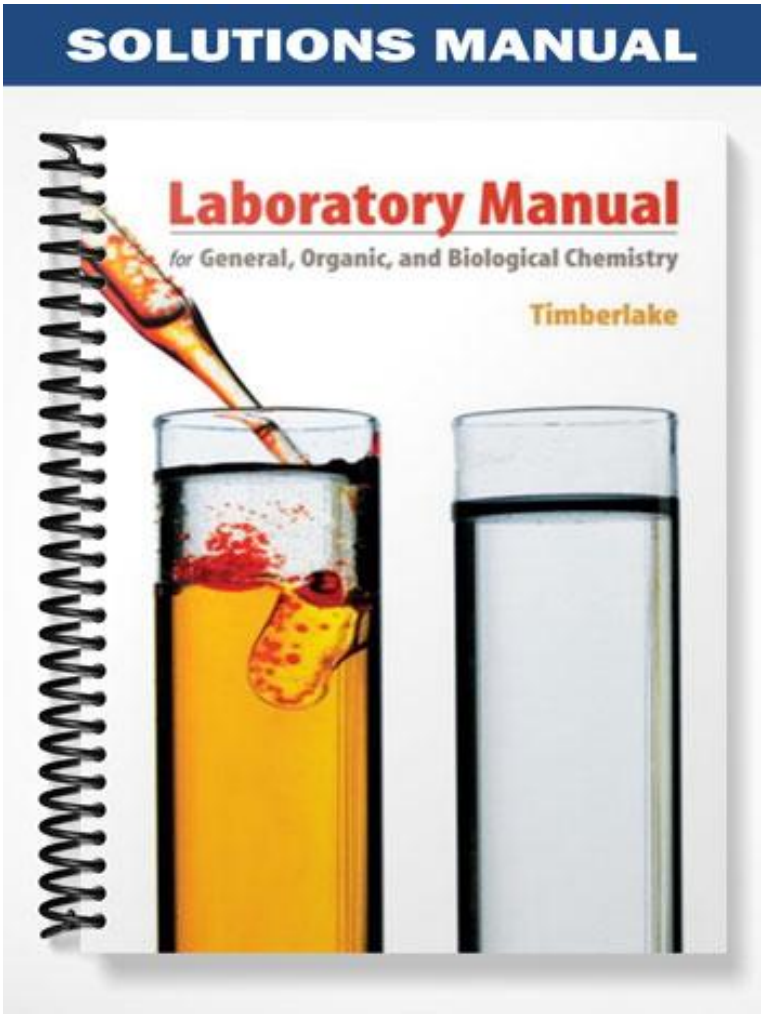
SOLUTIONS MANUAL



2

ConversionFactors in Calculations

Pre-lab Study Questions

1. What are the rules for rounding off numbers?
   If the first number to be dropped is less than 5, drop it and all following numbers. If the first number to be dropped is 5 or greater, drop the numbers and increase the last retained digit by one.

2. How do you determine the number of significant figures in an answer obtained by multiplying or dividing?
   Answers for multiplication/division keep the same number of significant figures as the measured number with the *fewest* significant figures.

3. How is the number of digits determined when an answer is obtained by adding or subtracting?
   For addition/subtraction, an answer has the same number of decimal places as the measured number with the *fewest* decimal places.

4. Is a body temperature of 39.4°C a normal temperature or does it indicate a fever?
   The temperature 39.4 indicates a fever. Normal body temperature is 39.0°C. Converting 39.4°C to Fahrenheit gives
   1.8 (39.4°C) + 32 = 102.9°C

5. What is an equality and how is it used to write a conversion factor?
   An equality is the same measurement expressed in two different units. A conversion factor is written by placing one of the units in the numerator and the other in the denominator. The two are reversed for a second factor for the equality.

A. Rounding Off

A.1 **Rounding** A student rounded off the following calculator display to three significant figures. Indicate if the rounded number is correct. If incorrect, round off the display value properly.

Calculator Display	Student's Rounded Value	Correct (yes/no)	Corrected (if needed)
24.4704	24.5	**Yes**	
143.63212 144		**Yes**	
532, 800	530	**No**	**533, 000**
0.00858345	0.009	**No**	**0.00858**
8	8.00	**Yes**	

Report Sheet - Lab 2

A.2 Area

	Your measurements	Another student's measurements
Length =	**13.29 cm**	**13.25 cm**
Width =	**4.32 cm**	**4.35 cm (3 sig figs)**
Area =	**57.4 cm^2**	**57.6 cm^2**

(Show calculations)

13.29 cm X 4.32 cm = 57.4 cm^2

13.25 cm X 4.35 cm = 57.6 cm^2 (3 sig figs)

Why could two students obtain difference values for the calculated areas of the same rectangle?

The estimated digit in each measurement will give some variation in the last digit of the calculated area.

A.3 ***Volume of A Solid by Direct Measurement***

Shape of solid **rectangular solid**

Formula for volume of solid **L X W X H = V**

height	**2.85 cm**	**length**	**4.82 cm**
width	**2.85 cm**	**diameter (*if cylinder)***	

Volume of the solid **39.2 cm^3**

(Show calculations of volume including the units)

4.82 cm X 2.85 cm X 2.85 cm = 39.2 cm^3 (3 sig figs)

Report Sheet - Lab 2

B. Significant Figures In Calculations

B.1 Perform the following multiplication and division calculations. Give a final answer with the correct number of significant figures:

4.5 × 0.28 **1.3**

0.1184 × 8.00 × 0.0345 **0.0300**

$\frac{(42.4)(15.6)}{1.265}$ **5.23**

$\frac{(35.56)(1.45)}{(4.8)(0.56)}$ **19**

B.2 Perform the following addition and subtraction calculations. Give a final answer with the correct number of significant figures.

13.45 mL + 0.4552 mL **13.91 mL** (2 decimal places)

145.5 m + 86.58 m + 1045 m **1277 m**

1315 + 200 + 1100 **2600** (last sig fig in hundreds place)

245.625 g - 80.2 g **165.4 g**

4.62 cm - 0.885 cm **4.53**

Questions and Problems

Q.1 What is the total mass in grams of objects that have masses of 0.2000 kg, 80.0 g, and 524 mg?

0.2000 kg X 1000 g/1 kg = 200.0 g
524 X 1 g/1000 mg = 0.524 g

Add 200.0 g + 80.0 g + 0.524 g = 280.5 g (one decimal place)

Q.2 A beaker has a mass of 225.08 g. When a liquid is added to the beaker, the combined mass is 238.254 g. What is the mass in grams of the liquid?

238.254 g – 225.08 g = 13.17 g (two decimal places)

C. Conversion Factors for Length

C.1 ***Metric Factors***

Equality **1 m = 1000 mm**

Conversion factors

$$\frac{\textbf{1 m}}{\textbf{1000 mm}} \textbf{ and } \frac{\textbf{1000 mm}}{\textbf{1 m}}$$

Equality **1 cm = 10 mm**

Conversion factors

$$\frac{\textbf{1 cm}}{\textbf{10 mm}} \textbf{ and } \frac{\textbf{10 mm}}{\textbf{1 cm}}$$

C.2 **Metric-U.S. Factors**

Line length (*measured)* **5 and 3/16 in. = 5 .19 in**

13.2 cm

$$\frac{\boxed{\textbf{13.2}}\ \text{cm}}{\boxed{\textbf{5.19}}\ \text{in.}} = \frac{\boxed{\textbf{2.54}}\ \text{cm}}{1\ \text{in.}}$$ (*Experimental ratio*)

How close is your *experimental ratio* to the standard conversion factor of 2.54 cm/in.?

It matches the standard value of 2.54 cm/in

Report Sheet - Lab 2

C.3 Y***our metric height***

Height (inches) **68.0 in.**

Height in centimeters (*calculated*)

$$\textbf{68.0 in.} \times \frac{\textbf{2.54 cm}}{\textbf{1 in.}} = \textbf{173 cm}$$

What is your height in meters? **1.73 m**

Show your calculations here

173 cm X 1 m/100 cm = 1.73 m

Questions and Problems *(Show complete set ups)*

Q.3 A pencil is 16.2 cm long. What is its length in millimeters (mm)?

16.2 cm X 10 mm/1 cm = 162 mm

Q.4 A roll of tape measures 45.5 inches. What is the length of the tape in meters?

45.5 in. X 2.54 cm/1 in. X 1 m/100 cm = 1.16 m

D. Conversion Factors for Volume

D.1 **Equality** 1 L = **1000** mL

Conversion factors $\frac{\textbf{1000} \text{ mL}}{\textbf{1} \text{ L}}$ and $\frac{\textbf{1} \text{ L}}{\textbf{1000} \text{ mL}}$

D.2 Volume (mL) of 1 quart of water **946** mL

Number of milliliters in 1 quart **946** mL/qt (*experimental)*

Equality 1 qt = **946** mL

Conversion factors $\frac{1 \text{ qt}}{946 \text{ mL}}$ and $\frac{946 \text{ mL}}{1 \text{ qt}}$

Questions and Problems *(Show complete set ups)*

Q.5 A patient received 825 mL of fluid in one day. What is that volume in liters?

825 mL X 1 L/1000 mL = 0.825 L

Q.6 How many liters of plasma are present in 8.5 pints? (1 qt = 2 pt)

8.5 pt X 1 qt/2 pt X 946 mL/1 qt X 1 L/1000 mL = 4.0 L

E. Conversion Factors for Mass

E.1 ***Grams and Pounds***

Name of Commercial Product **Stoned Wheat Thins**

Mass stated on label **340 g**

Weight given on label **12 oz**

Weight in lb *(convert oz to lb if needed):* **12 oz X 1 lb/16 oz = 0.75 lb**

$$\frac{\text{Number of grams}}{\text{Number of lb.}} = \frac{\boxed{\textbf{340 g}}}{\boxed{\textbf{0.75 lb}}} = \frac{\textbf{453 g}}{1\text{ lb}} \text{ or } \frac{\textbf{450}}{1\text{ lb}} \textbf{ (to 2 sig figs)}$$

How does your *experimental factor* compare to the standard value of 454 g/lb?

Very close

E.2 ***Pounds and Kilograms***

Mass in kilograms (*from label*) **0.34 kg**

Weight in lb: **0.75 lb**

$$\frac{\text{Number of lb}}{\text{Number of kg}} = \frac{\boxed{\textbf{0.75 lb}}}{\boxed{\textbf{0.34 kg}}} = \frac{\textbf{2.2 lb}}{1\text{ kg}}$$

How does your *experimental factor* compare to the standard value of 2.20 lb/kg?

Same value to first two sig figs.

Q.7 An infant has a mass of 3.40 kg. What is the weight of the infant in pounds?

3.40 kg X 2.20 lb/kg = 7.48 lb

or 3.40 kg X 1000 g/1 kg X 1 lb/454 g = 7.49 lb

F. Percent by Mass

F.1 Mass of the beaker (*0 if tared*) 0.00 g

F.2 Mass of the sugar + the beaker 4.75 g

F.3 Mass of the sugar-water mixture + beaker 23.76 g

F.4 **Calculations:**

What is the mass of sugar? **4.75 g**

What is the mass of the sugar-water mixture? **23.76 g**

What is the mass of the water added? **19.01 g**

What is the % sugar (by mass)? **20.5% sugar**

(Show calculations)

4.75 g sugar/23.76 g(sugar + water) × 100% = 20.0% sugar

What is the % water (by mass)? **80.0% water**

(Show calculations)

19.01 g/23.76 g (sugar + water) × 100% = 80.0 %

Questions and Problems *(Show complete setup)*

Q.9 A sugar-water mixture contains 45.8 g of sugar and 108.5 g of water. What is the percent by mass of sugar and the percent by mass of water in the solution?

Total mass = 45.8 g + 108.5 g = 154.3 g of solution

% sugar = 45.8 g/154.3g × 100 = 29.7 % sugar

%water = 108.5 g /154.3 g × 100 = 70.3% water

G. Converting Temperature

G.1 Temperature scale (s) on the thermometer **Celsius**

Lowest temperature **-20°C** Highest temperature **110°C**

G.2	°C	(G.3) °F	K
a. Room temperature	**27.0**	**80.6**	**300.**
	1.8(27.0) + 32 = 80.6°F		**27.0 + 273 = 300. K**
b. Tap water	**22.0**	**71.6**	**295**
	1.8(22.0) + 32 = 72.0°F		**22.0 + 273 = 295 K**
c. Ice-water mixture	**-1.0**	**30.2**	**272**
	1.8(-1.0)+ 32 = 30.2 °F		**-1.0 + 273 = 272** K
d. Salt ice-water mixture	**-8.0**	**17.6**	**265**
	1.8(-8.0) + 32 = 17.6°F		**-8.0 + 273 = 265 K**

Questions and Problems

Q.9 Write an equation for each of the following temperature conversions:

a. °C to °F **°F = 1.8 (T°C) + 32**

b. °F to °C **°C = $\frac{T°F - 32}{1.8}$**

c. °C to K **K = T°C + 273**

Q.10 A recipe calls for a baking temperature of 205°C. What temperature in °F should be set on the oven?

1.8 (205) + 32 = 369 – 32 = 401°F