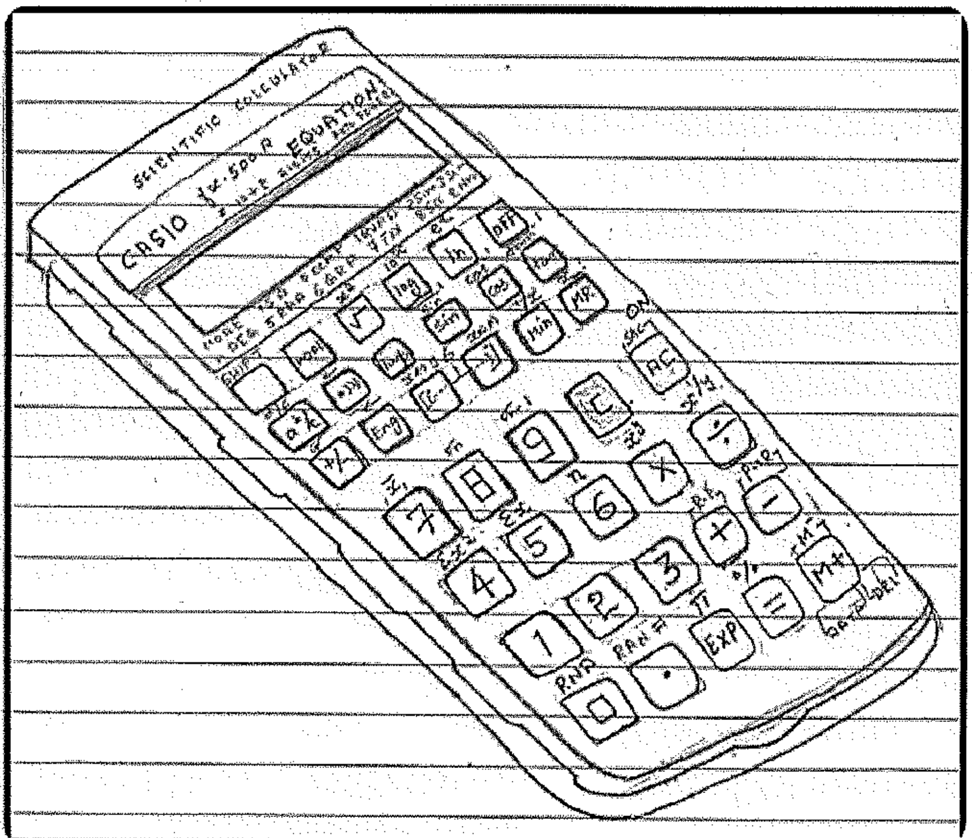
CP Chemistry
Mrs. Post

Chapter 2:
Measurements and Calculations



Name: ____________________

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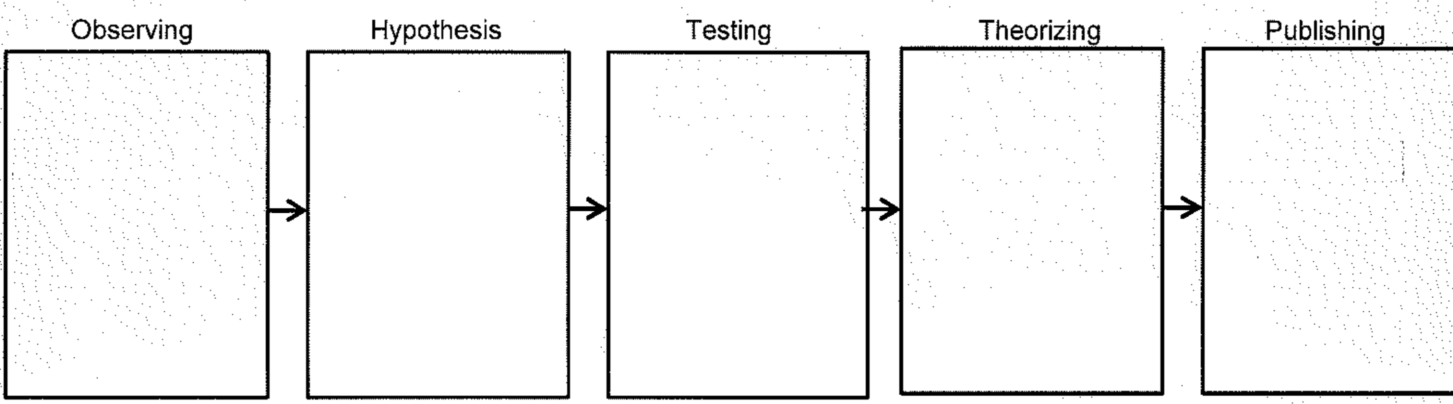
Chapter 2: Measurements & Calculations
Reading Guide

2.1 – Scientific Method *(pgs. 27-30)*

1) Define **scientific method**-

2) Fill in the flow diagram below as described in **Figure 1.3** which support the process of the scientific method:



3) Explain the difference between a **qualitative** observation and a **quantitative** measurement. Give an example of each to exemplify the difference.

2.2 – Units of Measurement *(pgs. 31-41)*

4) When using a balance in the laboratory, the **mass** of a substance is being measured and not its **weight**. Explain why mass is a better term.

5) Le Système International d'Unités – Complete the **SI Quantities** table below using **Figure 2.1**:

Quantity	Quantity Symbol	Unit Name	Unit Abbreviation
Length			
Mass			
Time			
Temperature			
Amount of Substance			
Electric Current			
Luminous Intensity			

6) Use the information in **Figure 2.2** to complete the table for common **metric prefixes**:

Prefix	kilo	hecto	deka	BASE	deci	centi	milli	micro	nano
Unit Abbreviation				m = meter L = liter g = gram					
Exponential Factor				10^0					
Meaning				1					

7) What are **derived units**? How are these units produced? Complete the table below from the information provided in **Figure 2.4**:

Quantity	Symbol	Unit	Abbreviation	Derivation
Area				
Volume				
Density				
Molar Mass				
Molar Volume				
Energy				

8) **Volume** is an example of a derived unit. What does it describe?

Useful relationship: **1.0 liter (L) = __________ dm^3 = __________ cm^3 = __________ mL**

9) Define the term **density** and explain why density is considered a physical property.

10) What are **conversion factors** and how are they used in dimensional analysis?

- Example of conversion factor expressed as **ratios**:

Define **dimensional analysis**-

$$\frac{\cancel{\text{given unit}}}{} \;\Big|\; \frac{\text{desired unit}}{\cancel{\text{given unit}}} = \text{desired unit}$$

► Use dimensional analysis to determine the **number of quarters in $12.00**. *(top pg. 39)*

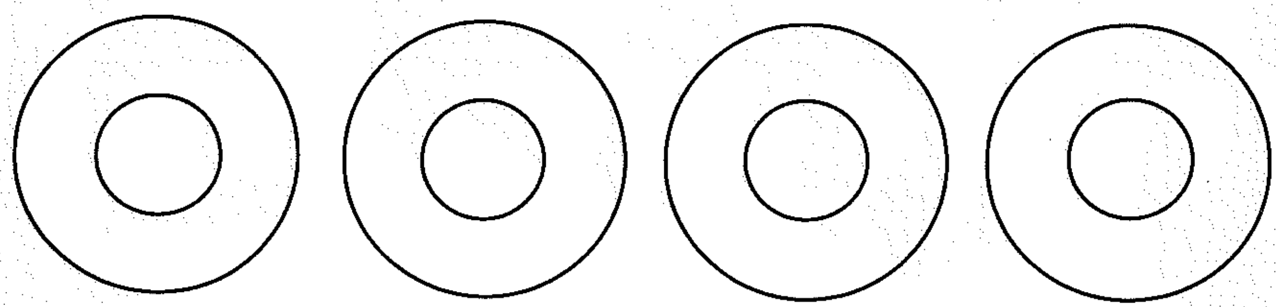
2.3 – Using Scientific Measurements *(pgs. 42-55)*

11) Define the following terms:

- **Accuracy-**

- **Precision-**

The game of darts is an excellent analogy for describing the difference between accuracy and precision. Complete the drawings by adding "darts" to describe the various scenarios:



high precision	high precision	low precision	low precision
high accuracy	low accuracy	low accuracy	high accuracy

12) **Percent Error** is an important way for a scientist to describe the accuracy of their experiment. You will use this calculation often in the lab when you compare your data and calculated results to the actual values (aka: accepted, theoretical). Write the **equation** to calculate percent error below:

13) What is meant by the term **significant figures** (sig. figs)? How does this apply to data collection?

14) Use **Figure 3.3** to list the four rules used to determine significant figures.

	Rule	Example
1.		
2.		
3.		
4.		

15) Summarize the guidelines used for working with significant figures when:

- Rounding-

  Example:

- Addition/Subtraction-

  Example:

- Multiplication/Division-

  Example:

16) **Scientific notation** will be used in many calculations throughout the year.

- Numbers *larger* than 1:

  1,350,000 = ______________________

- Numbers *smaller* than 1:

  0.000560 = ______________________

*** Take a moment to review **Figure 3.5** which describes using a scientific calculator for calculations involving scientific notation. Now locate the exponential button on your calculator and circle the correct description [EE] or [Exp] ***

17) Identify the four steps used in **problem solving**:

1.

2.

3.

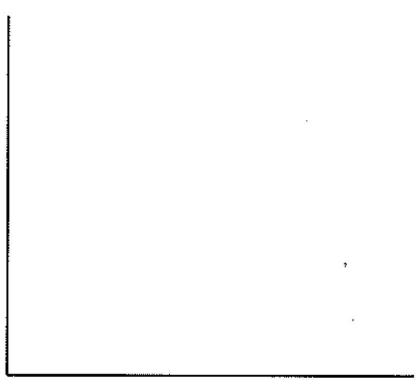
4.

18) Graphing:

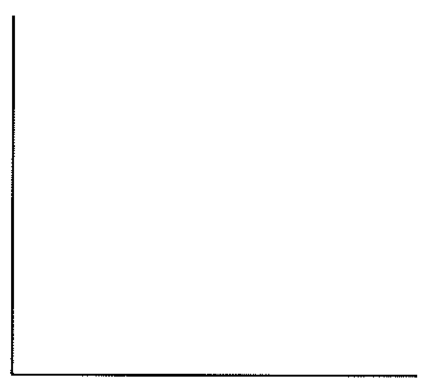
- What is meant by describing quantities as **directly proportional**?

- What is meant by describing quantities as **inversely (indirectly) proportional**?

- Draw the **characteristic shape** of these graphs below:



Direct Relationship



Inverse (Indirect) Relationship

Chapter 2: Notes and Practice

PART I - Significant Figures

A) Rules for Counting Sig. Figs:

1) All non-zero digits [1-9] are significant
2) Zeroes between any non-zero digits are significant [ex: 101]
3) Zeroes at the beginning of a number, before any non-zero digits, are *NEVER* significant [ex: 0.082]
4) Zeroes at the end of a number are significant ONLY if the number contains a decimal point [ex: 35.0 vs. 350 vs. 350.]

B) Practice Counting Sig. Figs:

1) ____________ 0.0034567 g
2) ____________ 2.97 mL
3) ____________ 6.700×10^3 m
4) ____________ 598.300 K
5) ____________ 78,000 mg
6) ____________ 9020 cm

C) Calculations w/ Sig. Figs:

Addition or Subtraction – round the answer off to the least number of decimal places

- **Ex)** 20.42 g + 7.9764 g + 102.3 g = ________________________________

- **Practice +/– w/Sig. figs:**

1) 15.002 cm + 24.1104 cm = ____________________
2) 22.35 kg – 0.154 kg = ____________________
3) 100.0 g – 23.73 g = ____________________
4) 2.030 mL – 1.870 mL = ____________________

Multiplication or Division – round the answers off to the least number of sig. figs.

- **Ex)** (6.221 cm)(5.2 cm) = ________________________________

- **Practice x/÷ w/Sig. figs:**

1) $\frac{75.246\ g}{6.33\ mL}$ = ____________________
2) (16.00 cm)(2.5 cm)(3.66 cm) = ____________________
3) 3.24 m x 7.00 m = ____________________
4) $\frac{710\ m}{3.0\ s}$ = ____________________

PART II – Scientific Notation

Scientists often deal with very small and very large numbers, which can lead to a lot of confusion when counting zeros! Therefore, we have learned to express numbers as powers of 10.

Scientific notation takes the form $M \times 10^n$ where $1 \leq M \leq 9$ and "n" represents the number of decimal places to be moved.

A) Write the numbers below in scientific notation:

1) 0.0034567 = ____________________

2) 72,100,000 = ____________________

3) 0.00000992 = ____________________

4) 44.3 = ____________________

B) Write the numbers below in standard notation:

1) 8.25×10^4 = ____________________

2) 2.1×10^{-3} = ____________________

3) 6.0×10^{-7} = ____________________

4) 1.05×10^5 = ____________________

C) How Your Calculator Works (with Scientific Notation)

To express the number 3,120,000,000,000,000,000,000,000,000 (3.0×10^{27}) in scientific notation, press these keys:

[3] [.] [1] [2] [EXP] [2] [7]

[EE]

[E]

[EEX] This mean "times ten to the" x 10

D) Use the exponent function on your calculator (EE or EXP) to compute the following

1) $8.354 \times 10^{-57} + 4.65 \times 10^{-59}$ = ______________________________

2) $6.02 \times 10^{23} / 3.6 \times 10^{18}$ = ______________________________

PART III – Percent Error

A) The accepted (theoretical) value for the boiling point of pure water is ______________, but your thermometer indicates that you have boiled water at a temperature of 99.1°C. What is your % error?

PART IV – Temperature

A) Temperature Conversions

1) Convert 37°C to K

2) Convert 77.2 K to °C

PART V – Density

A) Density/Mass/Volume Calculations

1) If the mass of a penny is 3.1 g and the volume of that same penny is 0.35 cm^3, what is the density of the penny?

2) The density of silver at 20°C is 10.5 g/cm3. What is the volume of a 68.0 g bar of silver?

PART VI – Dimensional Analysis

A) D.A. Problem Solving Steps:

1) Identify the unknown (what are you solving for)
2) Write down what is given or known
3) Look for relationships between the known and unknown.
**Note:* it may take more than one relationship to get from the known to the unknown*
4) Arrange the relationships into a ratio so that the given unit will cancel out and the desired unit will be left over.
5) Multiply numbers across the top of the expression and divide numbers on the bottom.

~~given unit~~	desired unit	=	desired unit
	~~given unit~~		

C) D.A. Example:

1) How many large pizzas will I need for a birthday party with 22 guests if I allow each person to eat 4 slices?

D) More Dimensional Analysis Practice: *Solve the following using dimensional analysis.*

1) How many decimeters are equal to 32.74 yards?

2) How many milliliters are in 2.35 gal of water?

3) Mrs. Post has been dating her husband for 13 years and 7 months. Assuming that a month is 30.5 days, how many seconds have Mrs. Post and her husband been together?

Significant Figures Practice

PART ONE: Determine the number of significant figures in the following numbers

1) _______ 96 kg
2) _______ 155.0 mg
3) _______ 100.060 cm
4) _______ 500. m
5) _______ 6.080×10^5 cg
6) _______ 0.0030 mm
7) _______ 4.0×10^{-3} cm
8) _______ 9000 cm

PART TWO: Round each of the following to <u>three</u> significant digits

1) 5963 cg = _______________
2) 0.004168 mm = _______________
3) 0.05199 cm = _______________
4) 6.4568×10^3 m = _______________
5) 2.801×10^{-6} m = _______________
6) 999, 915 g = _______________

PART THREE: When *adding and subtracting*, limit and round your answer to the <u>least number of decimal places</u> in any of the numbers that make up your answer.

1) 23.36 g + 5.6 g
2) 0.022580 m + 0.0095 m
3) 2514.6 g – 52.6 g
4) 15 m + 2.0 m + 7.32 m
5) 125.266 mL – 100.9 mL

PART FOUR: When *multiplying and dividing*, limit and round your answer to the <u>least number of significant figures</u> in any of the numbers that make up your answer.

1) (215.00 m)(0.020 m)
2) $(9.540 \times 10^5 \text{ cm})(2.1 \times 10^2 \text{cm})$
3) $\frac{25.36 \text{ g}}{5 \text{ mL}}$
4) $\frac{25.2 \text{ m}^3}{20.00 \text{ m}^2}$

Significant Figures and Calculations

PART ONE: Count how many significant figures are in the following numbers:

1) _______ 1234
2) _______ 0.023
3) _______ 890
4) _______ 91010
5) _______ 9010.0
6) _______ 1090.0010
7) _______ 0.00120
8) _______ 3.4×10^4
9) _______ 9.0×10^{-3}
10) _______ 0.00030
11) _______ 1020010
12) _______ 780.
13) _______ 1000
14) _______ 918.010
15) _______ 0.0001
16) _______ 0.00390
17) _______ 8120
18) _______ 9.010×10^{-2}
19) _______ 7.91×10^{-10}
20) _______ 72

PART TWO: Solve the following mathematical problems such that the answers have the correct number of significant figures:

1) 334.540 g + 198.9916 g = ____________________

2) 34.1 g / 1.1 mL = ____________________

3) 2.11×10^6 joules / 34 sec = ____________________

4) 0.0010 m – 0.11 m = ____________________

5) 349 cm + 1.10 cm + 100 cm = ____________________

6) 450 meters / 114 sec = ____________________

7) 298.01 kg + 34.112 kg = ____________________

8) 84 m/s x 31.221 sec = ____________________

Scientific Notation and Calculations

PART ONE: Express the following numbers in scientific notation.

1) 0.0084 ______________

2) 1623 ______________

3) 1,004,000 ______________

4) 0.0000019 ______________

5) 70.44 ______________

6) 0.00015 ______________

7) 86,524.7 ______________

8) 0.386 ______________

9) 1000 ______________

10) 529 ______________

PART TWO: Express each of the following numbers in standard notation

1) 1.0×10^{-2} ______________

2) 8.507×10^{9} ______________

3) 8.98×10^{6} ______________

4) 4.16×10^{-7} ______________

5) 7.03×10^{4} ______________

6) 3.65×10^{3} ______________

7) 2.64×10^{0} ______________

8) 6.1×10^{-3} ______________

9) 2.2×10^{1} ______________

10) 5×10^{-5} ______________

PART THREE: Use the exponent function on your calculator (EE or EXP) to compute the following

1) $5 \times 10^{-32} + 6.8 \times 10^{-32}$ = ______________

2) $2.75 \times 10^{86} + 7.52 \times 10^{84}$ = ______________

3) $8.46 \times 10^{-99} - 1.35 \times 10^{-89}$ = ______________

4) $9.75 \times 10^{46} - 2.46 \times 10^{64}$ = ______________

5) $(8.11 \times 10^{-59})(5.16 \times 10^{-40})$ = ______________

6) $(1.19 \times 10^{60})(4.6 \times 10^{16})$ = ______________

7) $4.19 \times 10^{-25} \div 6.9 \times 10^{-26}$ = ______________

8) $7.5 \times 10^{17} \div 9.32 \times 10^{35}$ = ______________

Scientific Notation & Calculations

PART ONE: Express each of the following in standard form.

1. 5.2×10^{3} ______________________
2. 9.65×10^{-4} ______________________
3. 8.5×10^{-2} ______________________
4. 2.71×10^{4} ______________________
5. 3.6×10^{1} ______________________
6. 6.452×10^{2} ______________________
7. 8.77×10^{-1} ______________________
8. 6.4×10^{-3} ______________________

PART TWO: Express each of the following in scientific notation.

1. 78,000 ______________________
2. 0.00053 ______________________
3. 250 ______________________
4. 2,687 ______________________
5. 16 ______________________
6. 0.0043 ______________________
7. 0.875 ______________________
8. 0.012654 ______________________

PART THEE: Use the exponent function on your calculator (EE or EXP) to compute the following.

1. $(6.02 \times 10^{23})\ (8.65 \times 10^{4})$

2. $(6.02 \times 10^{23})\ (9.63 \times 10^{-2})$

3. $\dfrac{5.6 \times 10^{-18}}{8.9 \times 10^{8}}$

4. $(-4.12 \times 10^{-4})\ (7.33 \times 10^{12})$

5. $\dfrac{1.0 \times 10^{-14}}{4.2 \times 10^{-6}}$

6. $\dfrac{7.85 \times 10^{26}}{6.02 \times 10^{23}}$

7. $(-3.2 \times 10^{-7})\ (-8.6 \times 10^{-9})$

8. $\dfrac{(5.4 \times 10^{4})\ (2.2 \times 10^{7})}{4.5 \times 10^{5}}$

9. $\dfrac{(6.02 \times 10^{23})\ (-1.42 \times 10^{-15})}{6.54 \times 10^{-6}}$

10. $\dfrac{(6.02 \times 10^{23})\ (-5.11 \times 10^{-27})}{-8.23 \times 10^{5}}$

11. $\dfrac{(3.1 \times 10^{14})\ (4.4 \times 10^{-12})}{-6.6 \times 10^{-14}}$

12. $\dfrac{(8.2 \times 10^{-3})\ (-7.9 \times 10^{7})}{7.3 \times 10^{-16}}$

13. $\dfrac{(-1.6 \times 10^{5})\ (-2.4 \times 10^{15})}{8.9 \times 10^{3}}$

14. $(7.0 \times 10^{28})\ (-3.2 \times 10^{-20})\ (-6.4 \times 10^{35})$

Metric Conversion

King	Henry	Died	Unusually 	Drinking	Chocolate	Milk
Kilo  **10 x 10 x 10 x LARGER than a unit**	Hecto **10 x 10 x LARGER than a unit**	Deca **10 x LARGER than a unit**	* Unit * ***Meter*** *(length)* ***Liter*** *(liquid volume)* ***Gram*** *(mass/weight)*	Deci **10 x SMALLER than a unit**	Centi **10 x 10 x SMALLER than a unit**	Milli **10 x 10 x 10 x SMALLER than a unit** 
1 kilo = 1,000 units	1 hecto = 100 units	1 deca = 10 units	**1 unit**	10 deci = 1 unit	100 centi = 1 unit	1,000 milli = 1 unit
km = kilometer kL = kiloliter kg = kilogram	hm = hectometer hL = hectoliter hg = hectogram	dam = decameter daL = decaliter dag = decagram	m = meter L = liter g = gram	dm = decimeter dL = deciliter dg = decigram	cm = centimeter cL = centiliter cg = centigram	mm = millimeter mL = milliliter mg = milligram
Example: 5 kilo	50 hecto	500 deca	5,000 units	50,000 deci	500,000 centi	5,000,000 milli

← **DIVIDE** numbers by 10 if you are getting bigger (same as moving decimal point one space to the left)

MULTIPLY numbers by 10 if you are getting smaller (same as moving decimal point one space to the right) →

Metric, in terms of exponents...

∞	10^{12}	10^{9}	10^{6}	10^{3}	**1**	10^{-3}	10^{-6}	10^{-9}	10^{-12}	Zero
	Tera	Giga	Mega	kilo		milli	micro (μ)	nano	pico	
	1,000.000,000,000	1,000.000,000	1,000,000	1,000		.001	.000001	.000000001	.000000000001	
	Ten	Grey	Mountain	kats		my	mom	knits	pelts	

METRICS AND MEASUREMENT

Name ____________

In the chemistry classroom and lab, the metric system of measurement is used, so it is important to be able to convert from one unit to another.

mega	kilo	hecto	deca	Basic Unit	deci	centi	milli	micro
(M)	(k)	(h)	(da)	gram (g)	(d)	(c)	(m)	(μ)
1,000,000	1000	100	10	liter (L)	.1	.01	.001	.000001
10^6	10^3	10^2	10^1	meter (m)	10^{-1}	10^{-2}	10^{-3}	10^{-6}

Factor Label Method

1. Write the given number and unit.
2. Set up a conversion factor (fraction used to convert one unit to another).
   a. Place the given unit as denominator of conversion factor.
   b. Place desired unit as numerator.
   c. Place a "1" in front of the larger unit.
   d. Determine the number of smaller units needed to make "1" of the larger unit.
3. Cancel units. Solve the problem.

Example 1: 55 mm = ____ m

$$\frac{55\ \text{mm}}{} \left| \frac{1\ \text{m}}{1000\ \text{mm}} \right. = 0.055\ \text{m}$$

Example 2: 88 km = ____ m

$$\frac{88\ \text{km}}{} \left| \frac{1000\ \text{m}}{1\ \text{km}} \right. = 88{,}000\ \text{m}$$

Example 3: 7000 cm = ____ hm

$$\frac{7000\ \text{cm}}{} \left| \frac{1\ \text{m}}{100\ \text{cm}} \right| \frac{1\ \text{hm}}{100\ \text{m}} = 0.7\ \text{hm}$$

Example 4: 8 daL = ____ dL

$$\frac{8\ \text{daL}}{} \left| \frac{10\ \text{L}}{1\ \text{daL}} \right| \frac{10\ \text{dL}}{1\ \text{L}} = 800\ \text{dL}$$

The factor label method can be used to solve virtually any problem including changes in units. It is especially useful in making complex conversions dealing with concentrations and derived units.

Convert the following.

1. 35 mL | ____ = ____ dL
2. 950 g | ____ = ____ kg
3. 275 mm | ____ = ____ cm
4. 1,000 L | ____ = ____ kL
5. 1,000 mL | ____ = ____ L
6. 4,500 mg | ____ = ____ g
7. 25 cm | ____ = ____ mm
8. 0.005 kg | ____ = ____ dag
9. 0.075 m | ____ = ____ cm
10. 15 g | ____ = ____ mg

Scientific Notation and Metric Unit Analysis

PART ONE: Change the following to scientific notation (maintain the number of significant figures):

1) 5.280 =	________	11) 2,560 =	________
2) 2,000 =	________	12) 0.0009 =	________
3) 15 =	________	13) 8,900,000 =	________
4) 6, 589,000 =	________	14) 0.0920 =	________
5) 70,400,000,000 =	________	15) 6,300 =	________
6) 0.00263 =	________	16) 0.90 =	________
7) 0.00589 =	________	17) 250 =	________
8) 0.006 =	________	18) 0.006087 =	________
9) 0.400 =	________	19) 500,000 =	________
10) 0.08060 =	________	20) 0.0000000105 =	________

PART TWO: Make the following metric system conversions using dimensional analysis:

1) 100 mg | ________ = ________ g

2) 20 cm | ________ = ________ m

3) 50 L | ________ = ________ kL

4) 22 g | ________ = ________ cg

5) 825 cm | ________ = ________ km

6) 2,350 kg | ________ = ________ g

7) 19 mL | ________ = ________ cL

8) 52 km | ________ = ________ m

9) 36 m | ________ = ________ cm

10) 18 cm | ________ = ________ mm

11) 6 g | ________ = ________ mg

12) 4,259 mg | ________ = ________ g

Percent Error Calculations

Percent error is a way for scientists to express how far off a laboratory value is from the commonly accepted value.

$$\% \text{ error} = \left| \frac{\text{accepted value} - \text{experimental value}}{\text{accepted value}} \right| \times 100$$

Accepted value (aka: theoretical value) = is the true, known value

Experimental value (aka: actual data) = the value determined from lab/experimental data

Even though percent error is an *absolute value* quantity (meaning the percentage reported will always be a positive value), it is very important to know whether the data you collected in an experiment was *LOWER* than accepted values or *HIGHER* than accepted values.

Directions: Determine the percent error in the following problems

1) John uses his lab thermometer and finds the boiling point of ethyl alcohol to be 75°C. He looks in a reference book and discovers that the true boiling point of ethyl alcohol is 78°C. What is his percent error?

2) The Handbook of Chemistry and Physics lists the density of acetone to be 0.7988 g/cm^3. Fred experimentally finds acetone to have a density of 0.7914 g/cm^3. Fred's teacher only gives an "A+" on a lab if the student is in within +/– 0.50% error. Will Fred be able to get an "A+" on this density lab? Show work to prove your answer.

3) In a lab, you are given a block of aluminum. You measure the dimensions of the block and its displacement in a container of a known volume of water. You calculate the density of the block of aluminum to be 2.68 g/cm^3. You look up the density of a block of aluminum at room temperature and find it to be 2.70 g/cm^3. Calculate the percent error of your measurement.

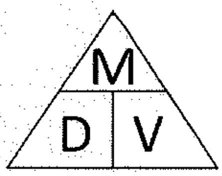
What's that got to do with density?

1) You are installing a new heating system in your house. You need to decide the most energy-efficient location for the heater vents - near the ceiling or near the floor? Explain your decision.

2) On a very hot day, you enter Stop 'n Shop to buy ice cream. As you walk down the freezer aisle, you notice that Alfred and Brian have just posted signs reminding customers to promptly close the doors of the upright freezers. You then realize that the horizontal freezers don't even have lids. How does the food stay frozen? Which freezer design is better for keeping cold air in? Explain.

3) Laura and Megan each return home hot and tired from a field hockey game and decide to have a glass of ice water. Having just studied density in chemistry class, they couldn't help noticing that the ice cubes always float to the top and get in the way as they tried to gulp the water. Why do ice cubes float? (yes - ice is less dense than water, but why?

4) Your muscular friend just returned from a trip to the ocean. He proudly claims that after years of trying, he is finally able to float on the water. He decides to show you at the local swim pool and immediately sinks. He insists that he floated while on vacation. Should you believe him?



Density Calculations

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

Units of Density:

Solids = g/cm^3

Liquids = g/mL

PART ONE: Solve for the unknown quantity. Show all your work and include proper units!

1) D = 3.0 g/mL V = 100 mL M = ?	2) D = ? V = 950 mL M = 95 g	3) D = 0.5 g/cm^3 V = ? M = 20 g

PART TWO:
Solve for the unknown quantity (convert first to g or mL). Show all your work and include proper units!

4) D = 24 g/mL V = 1.2 L = __________ mL M = ?	5) D = ? V = 100 mL M = 1.5 kg = __________ g	6) D = ? g/mL V = 0.52 L = __________mL M = 500 mg = __________g

PART THREE: Solve following word problems by setting up a "DEWA" system → data, equations, work, answer. Be sure to include proper units!

7) A block of aluminum occupies a volume of 15.0 mL and weights 40.5 g. What is its density?

8) Mercury metal is poured into a graduated cylinder that holds exactly 22.5 mL. The mercury used to fill the cylinder weights 306.0 g. From this information, calculate mercury's density.

Density Calculations

9) What is the mass of the ethanol that exactly fills a 200.0 mL container if the density of ethanol is 0.789 g/mL?

10) If the density of silver is 10.5 g/cm^3, what volume of silver metal will weigh exactly 2500 g?

11) Find the mass, **in kg**, of 250.0 mL of benzene. The density of benzene is 0.8765 g/mL. (Hint: watch your units!)

12) A block of lead has dimensions of 4.50 cm by 5.20 cm by 6.00 cm. If the block weights 1587 g, then what is the density of lead?

13) 28.5 g of iron shot is added to a graduated cylinder containing 45.50 mL of water. After adding the iron, the water level rises to the 49.10 mL mark. Calculate the density of iron.

Converting Units with Dimensional Analysis

Useful Conversions	1 qt = 2 pints	2.54 cm = 1 in	1 pound = 453.6 g
1 mL = 1 cm^3	1 L = 1.057 qts	0.621 mi = 1 km	16 oz = 1 lb
264.2 gal = 1 m^3	1 gal = 4 qts	1 mi = 5280 ft	1 ton = 2000 lbs
52 weeks = 1 yr	1 qt = 4 cups	1 yrd = 36 in	8 oz = 1 cup

Directions: Solve the following unit conversion problems with *dimensional analysis*. Report your answers with the *correct number of significant figures*.

1) The distance from Santa Maria to Los Alamos is 16.25 mi. What is the distance in meters?

2) Determine the number of years in 8.35×10^6 minutes.

3) Santa Maria has an elevation of 6.30×10^5 mm. How many yards is this elevation?

4) At the grocery store Alyssa bought a 12.5 ounce package of basil. How many grams of basil did Alyssa buy?

5) 0.0054 weeks is equivalent to how many seconds?

6) How many liters of water are in a 5.0 gallon water jug?

Unit Conversions & Dimensional Analysis

Directions: Use *dimensional analysis* and the useful conversions on the previous page to solve each of the following problems. Report your answers with the *correct number of significant figures*.

1) Convert 0.77 km to inches.

2) Convert 90 centuries to years

3) Convert 84 miles to centimeters

4) The moon is 250,000 miles away. How many feet is it from earth?

5) A family pool holds 10,000 gallons of water. How many liters is this?

6) The average American student is in class 330 minutes/day. How many seconds per day is this?

7) If a person weighs 145 lbs, how many mg does he/she weigh?

Chapter 2 - Review & Practice

PART ONE: Convert the following to scientific notation.

1) 45,700 ______________________________

2) 0.009 ______________________________

3) 0.9 ______________________________

4) 24,212,000 ______________________________

PART TWO: Convert the following to standard notation.

1) 6.65×10^{-4} ______________________________

2) 2.3×10^{1} ______________________________

3) 3.00×10^{7} ______________________________

4) 8.01×10^{-2} ______________________________

PART THREE: Make the following metric conversions using dimensional analysis (setup the boxes!):

1) 3.4 liters to milliliters

2) 45 meters to centimeters

3) 876 millimeters to meters

4) 11.7 grams to kilograms

PART FOUR: Determine how many significant figures are in the following measurements.

1) 0.420 g ____________

2) 2100 m ____________

3) 51.0 m ____________

4) 590 students ____________

5) 5,200.0 g ____________

6) 6020 mg ____________

PART FIVE: Use dimensional analysis to make the following conversions. Report your answers with the correct number of significant figures.

1) Convert 48,987 minutes to days

2) Convert 27 months to fortnights (there are 14 days in a fortnight and ~30 days in a month)

3) Convert 0.09 miles to inches.

4) Convert 4.66 centimeters to miles (there are 0.621 miles in a kilometers).

5) How many cups are equal to 9,452 mL (1 L = 1.057 qts; 1 qt = 4 cups)?

PART SIX: Convert the temperatures below from Kelvin to Celsius or vice-versa.

4) Convert 556 degrees Celsius to Kelvins.

5) Convert 25 Kelvins to degrees Celsius.

PART SEVEN: Answer the following mixed review questions from Chapter 2.

1) _____ A measured quantity is said to have good accuracy if

(a) it agrees closely with the accepted value.
(b) repeated measurements agree closely.
(c) it has a small number of significant figures.
(d) all digits in the value are significant.

2) Three students were asked to determine the volume of a liquid by a method of their choosing. Each performed three trials. The table below shows the results. The true volume of the liquid is 24.8 mL.

	Trial 1 (mL)	Trial 2 (mL)	Trial 3 (mL)	Average (mL)
Student A	24.8	24.8	24.4	24.7
Student B	24.2	24.3	24.3	24.3
Student C	24.6	24.8	25.0	24.8

________________ a) Considering the average of all three trials, which student's measurements show the greatest accuracy?

________________ b) Which student's measurements show the greatest precision?

3) Match the description on the right to the most appropriate quantity on the left.

______	2 m^3	(a)	mass of a small paper clip
______	0.5 g	(b)	length of a small paper clip
______	0.5 kg	(c)	length of a stretch limousine
______	600 cm^2	(d)	volume of a refrigerator compartment
______	20 mm	(e)	surface area of the cover of this workbook
		(f)	mass of a jar of peanut butter

4) A certain sample with a mass of 4.00 g is found to have a volume of 7.0 mL. To calculate the density of the sample, a student entered 4.00 ÷ 7.0 on a calculator. The calculator display shows the answer as 0.571429.

________________ a. Is the setup for calculating density correct?

________________ b. How many significant figures should the answer contain?

5) A lab sample, thought to be lead, occupies a volume of 15.00 mL and has a mass of 160.0 g.

a) Determine the density of the unknown (show work & units!)

b) If the accepted density of lead is 11.34 g/mL, can this unknown sample be pure lead? _______

c) Determine the percent error of this experiment using the experimental and accepted densities of lead from parts a and b above.