Unit 2 Standards

☑ if Mastered	Objective
	Derived Measurements 1. Standard SI units Volume ; Length; Mass; Density a. Prefixes (Ladder Method)
	2. Density Lab a. Remember procedures and materials b. Understand how to measure the volume of an irregular solid using a graduated cylinder
	3. Density Problems a. Remember your density Pyramid from your notes b. Given and unknown c. Equation your using d. Show your work with units e. Circle your answer (with units)
	4. Factor Label Method a. Show your work with units b. Circle your answer (with units)
	5. Scientific Notation a. Move the decimal behind the first whole number b. If you moved the decimal to the right the exponent is negative (-) c. If you moved the decimal to the left the exponent is positive (+)
	6. Sig Figs a. How many significant numbers are there in a given number?
	7. Accuracy vs Precision

Scientific Method

Please define the following terms:

Scientific Method:

Quantitative:

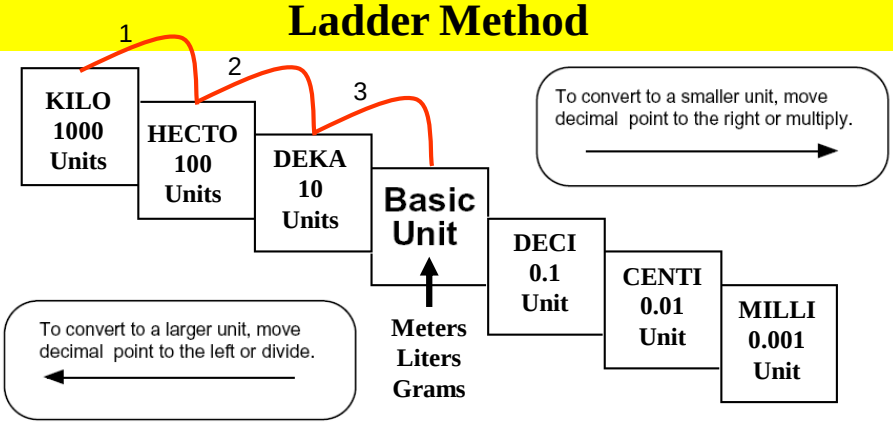
Qualitative:

Hypothesis:

Model:

Theory:

Ladder Method



How do you use the "ladder" method?

1st – Determine your starting point.

2nd – Count the "jumps" to your ending point.

3rd – Move the decimal the same number of jumps in the same direction.

4 km = _____ m

Starting Point Ending Point

How many jumps does it take?

4. _. _. _. = 4000 m

1 2 3

Metric Conversion Challenge

Write the correct abbreviation for each metric unit.

1) Kilogram _____

2) Meter _____

3) Gram _____

4) Milliliter _____

5) Millimeter _____

6) Liter _____

7) Kilometer _____

8) Centimeter _____

9) Milligram _____

Try these conversions, using the ladder method.

10) 2000 mg = _____ g

11) 104 km = _____ m

12) 480 cm = _____ m

13) 5.6 kg = _____ g

14) 8 mm = _____ cm

15) 5 L = _____ mL

16) 198 g = _____ kg

17) 75 mL = _____ L

18) 50 cm = _____ m

19) 5.6 m = _____ cm

20) 16 cm = _____ mm

21) 2500 m = _____ km

22) 65 g = _____ mg

23) 6.3 cm = _____ mm

24) 120 mg = _____ g

Name: Date: Measurement Conversions [Metric to Metric]

1. 3.68 kg = _____g

2. 568 cm = _____m

3. 8700 ml = _____l

4. 25 mg = _____g

5. 0.101 cm = _____mm

6. 250 ml = _____l

7. 600 g = _____kg

8. 8900 mm = _____m

9. 0.000004 m = _____mm

10. 0.250 kg = _____mg

Chemistry: ***Conversion Factors***

Below are some conversion factors used in the SI System, and which we will use in this class.

kilo- = 1000	**centi- = 1/100**	**milli- = 1/1000**	**Other**
1 kg = 1000 g		1000 mg = 1 g	1 mL = 1 cm^3
1 km = 1000 m	100 cm = 1 m	1000 mm = 1 m	1 L = 1 dm^3
1 kL = 1000 L		1000 mL = 1 L	1 cm = 10 mm

Solve each of the following problems. Show the correct set-up and always use units.

1. Determine the number of mm in 1600 m.

2. Determine the number of m in 1600 mm.

3. Determine the number of mm in 14.3 cm.

4. How many seconds are in 4.3 years?

5. Convert 2875 cm^3 to liters.

6. The density of lead (Pb) is 11.34 g/cm^3. Find the density of Pb in kg/dm^3.

7. Convert 5.2 cm of magnesium (Mg) ribbon to mm of Mg ribbon.

8. Convert 0.049 kg sulfur (S) to g of S

9. Convert 0.020 kg of tin (Sn) to mg of Sn.

Unit 2: Measurements Scientific Method Name: _____
Date: _____ Period: _____

Chemistry: *Conversion Factors*

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Solve each of the following problems. Show the correct set-up and always use units.

10. Convert 150 mg of acetylsalicylic acid (aspirin) to g of aspirin.

11. Convert 2500 mL of hydrochloric acid (HCl) to L of HCl.

12. A metallurgist is making an alloy that consists of 325 g of chromium (Cr) and 2.5 kg of iron (Fe). Find the total mass of the mixture in kg.

13. How many mL of water (H_2O) will it take to fill a 2 L bottle that already contains 1.87 L of H_2O?

14. Convert 150 cm of copper (Cu) wire into mm of Cu wire.

Density Worksheet

Density is the **ratio** of the **mass** of the substance to the **volume** of the substance at a given temperature. Density has units of **g/cm3 or g/c.c. or g/mL** for liquids and solids, and **g/L** for gases.

Density is an **intensive** property. Density **varies** with change in **temperature**.

1. A gold-colored ring has a mass of 18.9 grams and a volume of 1.12 mL. Is the ring pure gold? (The density of gold is 19.3 g/mL.)

2. What volume would a 0.871 gram sample of air occupy if the density of air is 1.29 g/L?

3. Pumice is volcanic rock that contains many trapped air bubbles. A 225 gram sample occupied 236.6 mL. What is the density of pumice? (Answer is 0.951 g/mL)
Will pumice float on water? The density of water is 1.0 g/mL.)

4. A cup of sugar has a volume of 237 mL. What is the mass of the cup of sugar if the density is 1.59 g/mL? (Ans. is 377 grams)

5. Which has the greater mass, 1 liter of water or l liter of gasoline? The density of water is 1.00 g/mL and that of gasoline is appoximately 0.68 g/mL.

6. A crumpet recipe calls for 175 grams of flour. According to Julia Child's data, the density of flour is 0.620 g/mL. How many mL of flour are needed for this recipe? (Ans. is 282 mL)

7. From their density values, decide whether each of the following substances will sink or float when placed in sea water, which has a density of 1.025 g/mL.
Gasoline 0.66 g/mL Asphalt l.2 g/mL
Mercury 13.6 g/mL Cork 0.26 g/mL

8. Mercury is a liquid metal having a density of 13.6 g/mL. What is the volume of 1.00 lb of mercury metal? (33.4 mL)

9. A sample of lead is found to have a mass of 32.6 g. A graduated cylinder contains 2.8 mL of water. After the lead sample is added to the cylinder the water level reads 5.7 mL. Calculate the density of the lead sample. (11g/mL)

10. A piece of magnesium is in the shape of a cylinder with a height of 5.62 cm and a diameter of 1.34 cm. If the magnesium sample has a mass of 14.1 g, what is the density of the sample? (1.78 g/mL)

Unit 2: Measurements Scientific Method Name: _____
Date: _____ Period: _____

Directions: Show ALL work in order to receive credit. Pay attention to units and sig figs at all time.

Substance	Density
Gold	19.3 g/mL
Mercury	13.6 g/mL
Copper	8.96 g/mL
Aluminum	2.70 g/mL
Water	1.00 g/mL
Styrofoam	0.145 g/mL
Helium	0.163 g/mL
Air	1.18 g/L

1. A rock has a volume of 15.2 mL and a mass of 54.99 grams. Determine its density.

2. 0.446 grams of hydrogen gas fills a 5.0 liter bag. Determine the density o f hydrogen.

3. A shiny chunk of metal is found to have a mass of 37.28 grams. The metal is dropped into a graduated cylinder which contains 20.0 mL of water. The volume of the cylinder rises to 34.0 mL. Determine the density of the metal. What might the metal be made of?

4. A graduated cylinder is placed on an electronic balance, and the scale reads 78.32 grams. 10.0 mL of glycerine are added, and the scale reads 91.78 grams. What is the density of glycerine?

5. A 3.00 cm x 4.52 cm x 6.71 cm brick has a mass of 985 grams. What is the brick's density?

6. What is the mass of a 17.4 mL piece of styrofoam ? What is the mass of the same size piece of gold?

Answers: Styrofoam _____ Gold _____

7. Determine the mass of a block of aluminum with the following dimensions: 15.92 cm x 2.98 cm x 10.20 cm

8. What volume would 23.82 grams of mercury occupy?

9. How large would a balloon filled with 25.00 grams of air be? How about a balloon filled with 25.00 grams of helium?

Answers: Air _____ Helium _____

Answers IRO: 21.2 L 0.089 g/L 1.35 g/mL 336 g 2.66 g/mL 10.8 g/mL 3.62 g/mL 153 L 2.52 g 17.7 mL 1.31 x 10^3 g 1.75 mL

Unit 2 • Measurement

TIME PROBLEMS & DIMENSIONAL ANALYSIS

Philosophy:

As chemistry students, you have two goals with problems. First, get the correct answer. Second, be able to show others WHY your answer is correct. Dimensional analysis meets both of these goals.

Dimensional analysis problems always involve a **Given** value and one or more **conversion factors** that allow you to determine the **Desired** value.

Any mathematical fact can serve as a conversion factor. 1 hour = 60 minutes $\approx \boxed{\frac{1hour}{60\min}}$ or $\boxed{\frac{60\min}{1hour}}$

Ex. Convert 1.25 years into seconds.

This = This	
1 inch	2.54 cm
1pound (lb)	454 g
1 cup	8 ounces (oz)
1 pint	2 cups
1 quart	2 pints
1 gallon	4 quarts
1 year	365 days
1 pound	16 ounces
1 ton	2000 pounds
1 mile	5280 feet

1. Convert 2.83 days into seconds.

2. Convert 7.72 years into days.

3. Convert 0.0035 weeks into seconds.

4. Convert 180 days into minutes.

5. Convert your age into seconds

Unit 2 • Observations, Models, & Experiments

DIMENSIONAL ANALYSIS PRACTICE

Show your setup with units for credit.

1. How many minutes will it take (counting 1 per second) to count to 1,000 seconds?

2. Convert 2.50 years into seconds.

3. Traveling at 65 miles/hour, how many minutes will it take to drive 2125 miles to San Diego.

4. Convert 50 years into seconds. Convert your answer in scientific notation.

5. Traveling at 65 miles/hour, how many feet can you travel in 22 minutes? (1 mile = 5280 feet)

Unit 2: Measurements Scientific Method Name: _____
Date: _____ Period: _____

Chemistry: *Real Life Chemistry (for the Business World)*

You work for Gateway as a purchasing agent. You are responsible for ordering certain parts for the newest model system. The following information is necessary for your order:

one system requires 12 widgets and 48 watzits	a watzit weighs 0.50 lbs.
one system takes up 2 ft^3 of space	a widget weighs 0.25 lbs.

Solve the following problems. Show your work and use units for full credit.

1. You are making 150 000 systems for next year.
   a. How many widgets must you order?

   b. How many watzits must you order?

2. a. How much will the widgets weigh?

   b. How much will the watzits weigh?

3. Your warehouse has a volume of 1 000 000 ft^3. How many systems can you place there?

4. You place your original order, but the factory producing watzits can only provide 2500 watzits.

   How many systems can you produce?

one system requires 12 widgets and 48 watzits	a watzit weighs 0.50 lbs.
one system takes up 2 ft^3 of space	a widget weighs 0.25 lbs.

5. If the factory producing watzits can only provide 2500 watzits…

    a. How many widgets will do you need to order now?

    b. What will the total weight of these widgets be?

6. It costs $0.30 per widget and $0.50 per watzit, what is the cost of…

    a. 1 system?

    b. 150 000 systems?

7. If each system sells for $250, how many systems must you sell to earn $1 000 000 dollars ***profit***?

Unit 2: Measurements Scientific Method Name: _____
Date: _____ Period: _____

Chemistry: *Real Life Chemistry*

Imagine you are working as a chemist at Dow Chemicals. You are responsible for ordering chemicals for a new fertilizer that Dow will be producing next year. The following information is necessary for your order…

1 mole contains 6.02×10^{23} molecules
1 mole of gas takes up 22.4 L (or 22.4 dm^3) of space
1 mole of fertilizer requires 2 moles of NH_3 and 3 moles of CH_4

Use the above information to solve the following problems. Show your work.

1. You are making 150 000 moles of fertilizer.

   a. How many moles of NH_3 do you need?

   b. How many moles of CH_4 do you need?

2. a. How much will the NH_3 weigh?

   b. How much will the CH_4 weigh?

3. Your storage tank holds 1 000 000 dm^3. How many moles of gas would it hold?

4. You place your order, but the company that provides CH_4 can only obtain 15 000 moles of CH_4. How many moles of NH_3 will you be able to use with this quantity of CH_4?

5. Using your information from question #4…

   a. How many molecules of NH_3 will you order?

   b. How much space will it take up?

   c. How much will it weigh?

ACCURACY AND PRECISION

Definitions:

Accuracy – how close a measurement is to

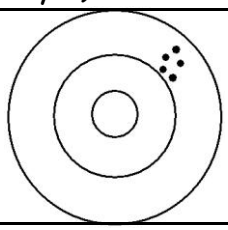
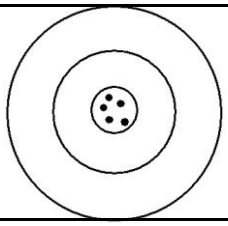
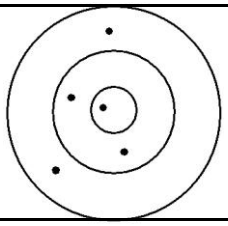
_____

Precision – how close a measurement is to

_____

Precision versus Accuracy:

Look at each target and decide whether the "hits" are accurate, precise, both accurate and precise, or neither accurate nor precise: (Note: An accurate "hit" is a bulls eye!)

		
Accurate?: Yes / No Precise?: Yes / No	Accurate?: Yes / No Precise?: Yes / No	Accurate?: Yes / No Precise?: Yes / No

Precision Problems:

A group of students worked in separate teams to measure the length of an object. Here are their data:

Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Team 7
2.65 cm	2.75 cm	2.80 cm	2.77 cm	2.60 cm	2.65 cm	2.68 cm

- The average length is _____ cm. This is the mean or average.
- Subtract the highest value from the lowest value: _____ cm. This is the range or spread.
- Divide this number by 2: _____ cm.
  This is the approximate ± range from the average.
- The precision of the measurement can be shown as average ± range. The precision of the measurement was _____±_____

- A second group of students obtained the following data:

Team 8	Team 9	Team 10	Team 11	Team 12	Team 13	Team 14
2.60 cm	2.70 cm	2.80 cm	2.75 cm	2.65 cm	2.62 cm	2.78 cm

- The average length is _____ cm.

- The precision of the measurement was _____±_____ cm.

In comparing groups, the first or the second, which group was more precise or was the precision the same? **Justify your answer.**

Expressing Errors in Measurement:

Scientists often express their uncertainty and error in measurement by giving a percent error. The percent error is defined as:

$$\% \text{ error} = \frac{\text{actual value} - \text{measured value}}{\text{actual value}} \times 100$$

Answer the following four questions. Pay attention to significant figures, and **show your work!**

1. While doing a lab, a student found the density of a piece of pure aluminum to be 2.85 g/cm^3. The accepted value for the density of aluminum is 2.70 g/cm^3. What was the student's percent error?

2. A student measured the specific heat of water to be 4.29 J/g · C^o. The literature value of the specific heat of water is 4.18 J/g · C^o. What was the student's percent error?

3. A student took a calibrated 200.0 gram mass, weighed it on a laboratory balance, and found it read 196.5 g. What was the student's percent error?