UNIT 2

Measurement

Mrs. Clark and Mr. Boylan

Unit 2

Measurement

2.1 Units of Measurement

2.2 Metric Prefixes

2.3 Scientific Notation

2.4 Significant Figures, Accuracy, and Precision

2.5 Denisty

Measurement Unit Outline

Topic	Date	Homework	Vocab
Units of Measurement		Using textbook pages 17 - 18, fill in the metric prefix table on in the next section.	SI Units, base units, derived units
Metric Prefixes		Complete the metric conversion worksheet. Upload to Google Classroom. Read pages 14-15 in your textbook.	Prefix
Scientific Notation		Complete the scientific notation worksheet and submit on Google Classroom. Read page 19 in your textbook and define the terms accuracy and precision in the following section.	
Accuracy, Precision, and Significant Figures		Complete the significant figures worksheet and upload to Google Classroom. Define density in the spot in the next section.	Accuracy, Precision
Density		Complete your density calculations. Make up 2-3 of your own density problems that you can share with a classmate.	Density, Mass, Volume

Section 2.1

Units of Measurement

TOPICS

1. SI Base Units
2. SI Derived Units

SI Units of Measurement

Back in the day, people measured things compared to their body parts. Ever wonder why a foot is called a foot? Eventually, people realized that this was a terrible idea because people have different sized feet. Their solution was to create a standardized system of measurements known as the Metric System.

These people are actually signing the Declaration of Independence but I'm sure this is what the meeting about the metric system would have looked like.

In 1799, the metric system was officially adopted in France. In 1960, the system was modernized and changed names to the *Système International d'Unités*, or **SI Units** for those of us out there that don't speak French.

Almost every country in the world uses SI Units. The map below highlights in red all the countries that DO NOT use SI Units.

Hey! Guess what country that big red spot is!

SI Base Units

Based units can be measured directly from an item itself. You've probably already heard of many of the SI Units out there. Using the interwebs, fill in the chart with the SI base units.

SI Base Units			
Quantity	Unit	Symbol	Examples

SI Derived Units

Derived units cannot be measured directly from an item, but must be calculated by using two or more base units. For example, you can measure the length and width of a object using the base unit meter (m), but can only find the area by multiplying these two measurements together which creates a unit of meters squared (m^2). Go online and research as many SI derived units as you can. Choose at least 6 to include below.

SI Derived Units			
Quantity	Unit	Symbol	Examples

Homework Section 2.1

Using textbook pages 17 - 18, fill in the metric prefix table on in the next section.

Section 2.2

Metric Prefixes

TOPICS

1. Prefix Meanings
2. Converting

SI Prefixes			
Prefix	Symbol	Meaning	Multiply Unit By

Converting

There are two methods you can use to convert between prefixes: the “King Henry” method or the conversion factor method.

King Henry

King	Henry	Doesn’t	Usually	Drink	Chocolate	Milk
kilo	*hecto*	*deca*	*unit*	*deci*	*centi*	*milli*

Conversion Factors

A conversion factor is a ratio of two different units that measure out to the same amount. For example,

$$\frac{12 \text{ inches}}{1 \text{ foot}} \quad \text{or} \quad \frac{1 \text{ foot}}{12 \text{ inches}}$$

can both be used to convert between a measurement in inches and a measurement in feet.

Here is an example of using a conversion factor to convert between inches and feet:

$$3 \text{ inches} \times \frac{1 \text{ foot}}{12 \text{ inches}} = 0.25 \text{ feet}$$

Section 2.2 Homework:

Complete the metric conversion worksheet. Upload to Google Classroom. Read pages 14-15 in your textbook.

Section 2.3

Scientific Notation

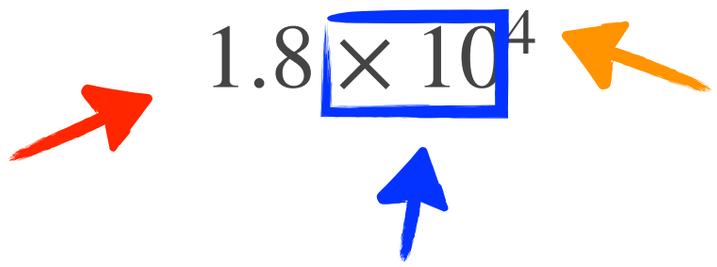
TOPICS

1. Features of Scientific Notation
2. Converting into Scientific Notation
3. Converting out of Scientific Notation

Features of Scientific Notation

Carlos Slim is currently the world's richest person with a personal net worth estimated at $84,400,000,000. The Earth has a mass of 5,972,190,000,000,000,000,000,000 kilograms. An atom is roughly .00000000006 meters wide. What's the problem with all of these numbers? The amount of zeros they have make them incredibly difficult to write. Therefore, scientists use scientific notation.

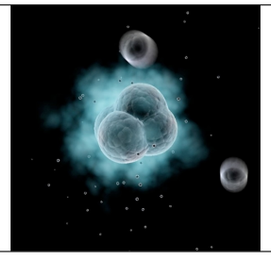
Scientific notation needs three main components:



Converting into Scientific Notation

1. Move the decimal over so that your number is between 1 and 10. Remove place-holding zeros.
2. Write $\times 10$ and add an exponent that reflects how many times you moved your decimal point. If you moved the decimal to the right, your exponent is negative. If you moved the decimal to the left, your exponent is positive.

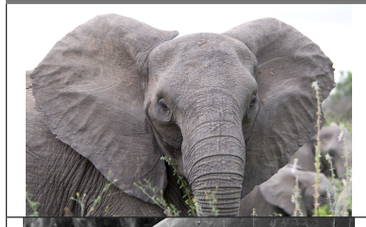
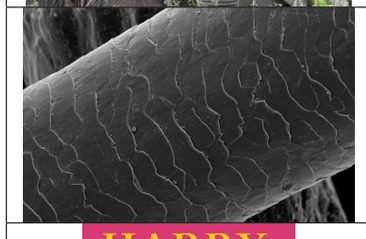
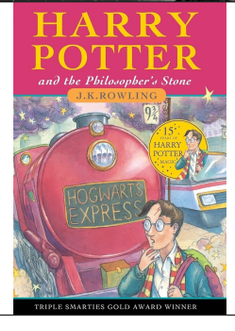
Convert the numbers mentioned on the last page into scientific notation:

	Standard Notation	Scientific Notation
	$84,400,000,000	
	5,972,190,000,000,000,000,000,000 kilograms	
	0.00000000006 meters	

Converting out of Scientific Notation

1. Move your decimal point the same number of places as the exponent. If the exponent is positive, move to the right. If the exponent is negative, move to the left.
2. Fill in any blank spaces you moved with zeros.

Convert the following numbers out of scientific notation:

	Scientific Notation	Standard Notation
	5.5×10^3 kg	
	1.7×10^{-7} m	
	1.07×10^6 copies sold	

Scientific Notation and your Calculator

Calculators and some computer applications will not write out the complete form of scientific notation but will display it as this:

What they really mean by this is 6.022×10^{23}. Now, if you see this in your calculator, you know what it really means. You must write out the full version on all assignments including labs, classwork, homework, tests, and quizzes.

Section 2.3 Homework:

Complete the scientific notation worksheet and submit on Google Classroom. Read page 19 in your textbook and define the terms accuracy and precision in the following section.

Section 2.4

Significant Figures, Accuracy, and Precision

TOPICS

1. Accuracy
2. Precision
3. Significant Figures

Accuracy

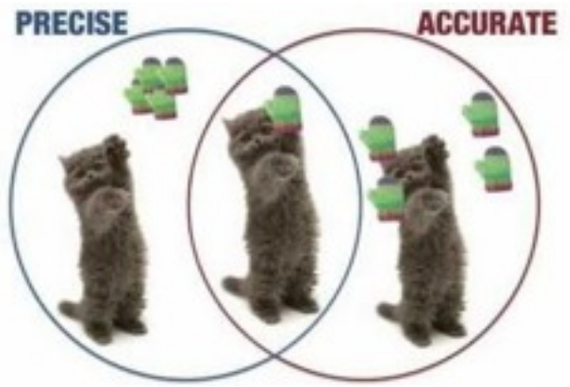
Accuracy is:

An example of accurate:

Precision

Precision is:

Give an example of one measurement that is more precise than another:



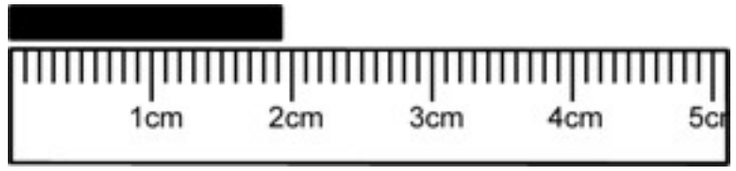
Decide if these images show accuracy, precision, both, or neither:

Students were asked to measure the length of the class's pet inchworm. The inchworm's length is 5.34 cm. Look at the data and decide if the measurements are accurate, precise, both, or neither.

Natalie	Jose	Marjorie	Melissa
5.0	3.4	5.3	4
7.12	3.7	5.2	5.5
1.8	3.3	5.31	6

Significant Figures

Significant figures, also called significant digits, show how precise a measurement is. When you measure, write down all measurements you are sure of and one estimation.



The greater the number of significant figures there are, the more precise your measurement it. Any number you measure is significant. However, sometimes you need to determine how many numbers are significant in a number you didn't measure. For that, you need to follow three rules:

1. All non-zero numbers are significant (1-9)
2. The sandwich effect: Any zeros between significant digits are significant.
3. The combo rule: If a zero comes after a number AND a decimal it is significant.

Section 2.4 Homework:

Complete the significant figures worksheet and upload to Google Classroom. Define density in the spot in the next section.

Section 2.5

Density and Measurement in Practice

TOPICS

1. Density
2. Calculations
3. Measurement methods

Density

Density =

Mass =

Volume =

Density is an important property because it remains constant for a substance. This is useful if you have an unknown substance and need to determine what it is. Density is also related to floating in that more dense items will sink and less dense items will float.

Density can easily be calculated using two measurements: mass and volume. Use the formula:

$$d = \frac{m}{V}$$

When solving math problems:

1. List your variables
2. Write the correct formula
3. Substitute in your variables
4. Solve and show work
5. Write the correct answer with the correct number of significant figures and units

Each one of these steps will gain you one point for the problem for a total of 5 points.

What is the density of 15 mL of cheese that has a mass of 1.2 g?

What is the density of a 9.01 cm^3 cookie that has a mass of 5.0 g?

A french fry has an approximate density of 0.380 g/cL and a mass of 4.00 g. What is the volume of said french fry?

A bowl of risotto has a density of 2.3 kg/L and a volume of 0.80 L. What is the mass of the bowl of risotto?

Calculating Density

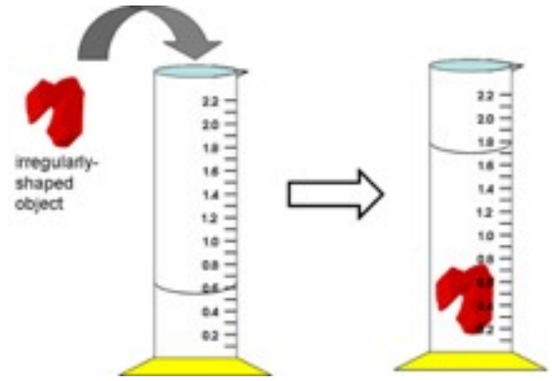
Density is a derived unit, so it must be calculated from other measurements.

Measuring Mass

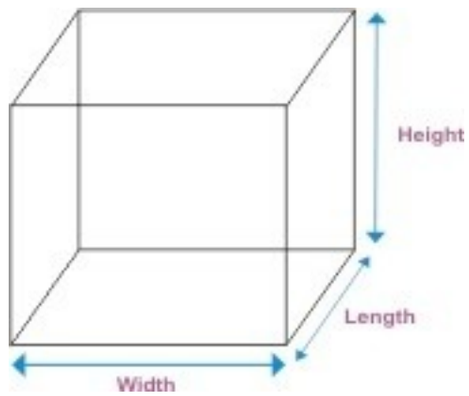
Mass should be measured using a balance set to grams.

Measuring Volume

Volume can be obtained two ways. Volume can indirectly be measured by measuring how much water it pushed out of the way. This works well for objects with irregular shapes.



Additionally, you could measure the length, width, and height and multiply them to determine the volume. However, this method only works for items with straight sides.



Your task: Find the density of 5 items that you have in your possession. You must use both of the different volume methods at least once. Make a data table on the blank side of this page and record your information there. On the next page, show all of your density calculations. Measure first, calculate after.

Section 2.4 Homework:

Complete your density calculations. Make up 2-3 of your own density problems that you can share with a classmate.

Measurement Unit Exam:

The test for this unit will cover both measurement AND the scientific method. To study, review the two unit workbooks on your iPad. In the textbook, look at the “Study Guide,” “Assessment,” and “Standardized Test Prep” at the end of both chapters (pp. 28-31).