Activity 1: Scientific Notation and the Metric System

Why?
- In science we often deal with numbers that are sometimes very large (ex. the distance to the sun from the earth is 93,000,000 miles) or very small (ex. the size of a bacterial cell is .000001 meters). Working with such numbers can be cumbersome, so a method of uniform representation is helpful.
- A system of units is important to help represent various sizes and physical descriptions of matter. The standard system of units for science is the Metric System as it is very uniform and based on a decimal system (ie. units of ten for all measurements).

Learning Objectives
- Be able to convert numbers into scientific notation and work with these numbers in that format.
- Understand the basic measurement of length, mass and volume in the Metric System.
- Convert units between English and Metric standards.
- Express one Metric measurement in terms of another (ex. How many cm’s are in 1 m?)

Success criteria
- Quickly place numbers into scientific notation.
- Transfer English measurements into metric.
- Easily transform one metric measurement into another unit scale.

New Concepts
- Exponential notation format, metric designations

Vocabulary
- meter (m), gram (g), liter (L)
- kilo, deca, deci, centi, milli, micro, nano
Scientific Notation

The following basic rules are to be followed when applying scientific notation to a number larger than one:

1. Any non-zero numbers (as well as zeros between non-zero numbers) will make up the coefficient.
   ex. 340500. = \(3.405 \times 10^5\)

2. The second portion of the notation is the “10” with an exponent and is called the base.
   ex. 340500. = 3.045 \(\times 10^5\)

3. Count the spaces from the existing decimal point to a place one numeral to the left of the last non-zero number. This number of spaces will be your exponent.

Try placing the following numbers into Scientific Notation:

8730

619035

4538901

235

1743975432
The following basic rules are to be followed when applying scientific notation to a number smaller than one:

1. Any non-zero numbers (as well as zeros between non-zero numbers) to the right of the decimal point will make up the coefficient.

   ex. $0.00000187 = 1.87 \times 10^{-6}$

2. The second portion of the notation is the “10” with an exponent and is called the base.

   ex. $0.00000187 = 1.87 \times 10^{-6}$

3. Count the spaces from the existing decimal point to a place one numeral to the right of the first non-zero number. This number of spaces will be your exponent and is designated with a negative sign to denote a place marker to the right.

Try placing the following numbers into Scientific Notation:

0.895  _____________________________

0.0345  _____________________________

0.23005  _____________________________

0.0000010  _____________________________

0.000589  _____________________________
Metric System

The metric system is currently the unit system of choice in all major countries except the United States. For scientific purposes it is always used. First developed in the 1790’s by the French Academy of Science, the metric system is actually called “SI” now for “Systeme International d’Unites”. The system is based on units of ten and makes for a very uniform and easy to remember naming regimen for measurement parameters such as length, mass and volume.

The basic units are as follows:

<table>
<thead>
<tr>
<th>Metric Unit</th>
<th>English Equivalents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length – meter (m)</td>
<td>1m = 3.3 ft or 1.1 yds</td>
</tr>
<tr>
<td>Mass – gram (g)</td>
<td>1000g = 2.2 lbs</td>
</tr>
<tr>
<td>Volume – liter (L)</td>
<td>1L = 1.1 qt or 0.26 gallons</td>
</tr>
</tbody>
</table>

Convert the following English measurements into the requested Metric units:

Ex. How many grams are in 4 lbs? (use conversion factor 1000g/2.2 lbs)

\[
4 \text{ lbs} \times \frac{1000 \text{g}}{2.2 \text{ lbs}} = \frac{4000}{2.2} \text{g} = 1818.2 \text{g (note lbs units cancel leaving only g)}
\]

6 lbs = _______________ g

3 gallons = _______________ L

12 ft. = _______________ m

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The following prefixes are used to indicate when the base unit is multiplied or divided by units of tens:

<table>
<thead>
<tr>
<th>Name</th>
<th>Unit</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>kilo (k)</td>
<td>x1,000</td>
<td>1 kg = 1000g</td>
</tr>
<tr>
<td>deca (da)</td>
<td>x10</td>
<td>1 dag = 10g</td>
</tr>
<tr>
<td>deci (d)</td>
<td>÷10</td>
<td>1 dg = 0.1g</td>
</tr>
<tr>
<td>centi (c)</td>
<td>÷100</td>
<td>1 cm = 0.01m or 100 cm = 1m</td>
</tr>
<tr>
<td>milli (m)</td>
<td>÷1,000</td>
<td>1 mm = 0.001m or 1000mm = 1m</td>
</tr>
<tr>
<td>micro (µ)</td>
<td>÷1,000,000</td>
<td>1 µm = 0.000001m or 1000µm = 1mm</td>
</tr>
<tr>
<td>nano (n)</td>
<td>÷1,000,000,000</td>
<td>1 nm = 0.00000001m or 1000nm = 1µm</td>
</tr>
</tbody>
</table>

Convert the following metric measurements into the requested units:

1 m = _____________ mm

1 mm = _____________ cm

0.5L = _____________ mL

1g = _____________ µg

1 ng = _____________ mg

DONE!