The SI System of Measurement

The Nature of Measurement

A Measurement is a quantitative observation consisting of TWO parts

Part 1 - number
Part 2 - scale (unit)

Examples:
- 20 grams
- $6.63 \times 10^{-34}$ Joule·seconds

The Fundamental SI Units

<table>
<thead>
<tr>
<th>Physical Quantity</th>
<th>Name</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>kilogram</td>
<td>kg</td>
</tr>
<tr>
<td>Length</td>
<td>meter</td>
<td>m</td>
</tr>
<tr>
<td>Time</td>
<td>second</td>
<td>s</td>
</tr>
<tr>
<td>Temperature</td>
<td>Kelvin</td>
<td>K</td>
</tr>
<tr>
<td>Electric Current</td>
<td>Ampere</td>
<td>A</td>
</tr>
<tr>
<td>Amount of Substance</td>
<td>mole</td>
<td>mol</td>
</tr>
<tr>
<td>Luminous Intensity</td>
<td>candela</td>
<td>cd</td>
</tr>
</tbody>
</table>

What is missing?

SI Prefixes

Common to Chemistry

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Unit Abbr.</th>
<th>Exponent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilo</td>
<td>k</td>
<td>$10^3$</td>
</tr>
<tr>
<td>Deci</td>
<td>d</td>
<td>$10^{-1}$</td>
</tr>
<tr>
<td>Centi</td>
<td>c</td>
<td>$10^{-2}$</td>
</tr>
<tr>
<td>Milli</td>
<td>m</td>
<td>$10^{-3}$</td>
</tr>
<tr>
<td>Micro</td>
<td>µ</td>
<td>$10^{-6}$</td>
</tr>
</tbody>
</table>
Why use SI system rather than English measuring system?

- English system can be confusing
  - 1 yard = \( \frac{3}{3} \) feet
  - 1 foot = \( \frac{12}{3} \) inches
  - 1 mile = \( \frac{5280}{5} \) feet

- A furlong is another measure of length.
  - It is equal to 660 feet, or 40 rods, or 10 chains.

- There is no easy way to convert from one unit to another

Strange English Units

**Length**
- Barleycorn = 1/3 inch
- Palm = 3 inches
- Link = 7.92 inches or 1/100\(^{th}\) of a chain
- Fathom = 6 feet
- League = 3 miles

**Volume**
- Mouthful
- Gill
- Bushel
- Hogshead
- Barrel

**Metric Conversions**

Conversions in the metric system are merely a matter of moving a decimal point. The "base unit" means the you have a quantity (grams, meters, Liters, etc) without a prefix.

Example #1: Convert 18 liters to milliliters

18 liters = 18 000 milliliters
Example #2: Convert 450 milligrams to grams

450 mg = 0.450 g

Example #3: Convert 20 kilograms to milligrams

20 kg = 20 000 000 mg