Module 1: Measurement and Units

Mark Peever mpeever@gmail.com

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Psalm 107:23–32

1 Overview

1. **Matter** is anything that has *mass* and takes up space
2. **Units of Measurement** make numbers meaningful
3. **S. I.** (or **the metric system**) is designed to make units measurement consistent and simple
4. **Unit Conversion** is based on multiplying fractions
5. **Significant Figures** are a convention for maintaining precision in measurements
6. **Scientific Notation** allows us to represent numbers "naturally"

2 Scientific Notation

We can represent numbers as multiples of factors of 10. This is particularly helpful with very large or very small numbers.

The rules for scientific notation are:

1. the first number is between 1 and 10
2. the power of 10 is the number of places you move the decimal to the *left*
3. if you move the decimal to the *right*, then the power of 10 is negative

Notice that the metric system is just scientific notation with pretentious names!

Metric Prefix	Scientific Notation Equivalent
mega	$\times 10^6$
kilo	$\times 10^3$
milli	$\times 10^{-3}$
micro	$\times 10^{-6}$.

2.1 Examples

Example 1 we can write 1000 as 1×10^3

Example 2 we can write 256 as 2.56×10^2

Example 3 we can write 0.000002341 as 2.341×10^{-6}

3 Unit Conversion

We use the idea of faction multiplication to convert measurements between units. **Remember: we can always multiply any number by** 1 **without changing it!**

3.1 Examples

Example 1 How many yards in a mile?

We begin with what we know:

- $1mile = 5280ft$
- $1yd = 3ft$

$$
\begin{aligned}
1mile &= (\frac{1mile}{1})(\frac{5280ft}{1mile})(\frac{1yd}{3ft}) \\
&= \frac{(1\cancel{mile})(5280\cancel{ft})(1yd)}{(1\cancel{mile})(3\cancel{ft})} \\
&= \frac{5280yd}{3} \\
&= \frac{5280}{3}yd \\
&= 1760yd
\end{aligned}
\tag{1}
$$

Example 2 How many cups are in 5 liters?

We begin with what we know:

- $1quart = 2pints$
- $1pint = 2cups$
- $1quart = 0.946353L$

$$\boxed{\begin{aligned} 5L &= (\frac{5L}{1})(\frac{1qt}{0.946353L})(\frac{2pint}{1qt})(\frac{2cup}{1pint}) \\ &= (\frac{5\cancel{L}}{1})(\frac{1\cancel{qt}}{0.946353\cancel{L}})(\frac{2\cancel{pint}}{1\cancel{qt}})(\frac{2cup}{1\cancel{pint}}) \\ &= \frac{5 \cdot 2 \cdot 2cup}{0.946353} \\ &= \frac{5 \cdot 4 \cdot 2}{0.946353}cup \\ &= \frac{20}{0.946353}cup \\ &= 21.1338cup \end{aligned}} \tag{2}$$