

Module 1: Measurement and Units

Mark Peever mpeever@gmail.com

June 26, 2025

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
<i>mega</i>	$\times 10^6$
<i>kilo</i>	$\times 10^3$
<i>milli</i>	$\times 10^{-3}$
<i>micro</i>	$\times 10^{-6}$.

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 fraction 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:

- $1 \text{ mile} = 5280 \text{ ft}$
- $1 \text{ yd} = 3 \text{ ft}$

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

Example 2 How many cups are in 5 liters?

We begin with what we know:

- $1 \text{ quart} = 2 \text{ pints}$
- $1 \text{ pint} = 2 \text{ cups}$
- $1 \text{ quart} = 0.946353 \text{ L}$

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