

Skill 2: Estimating metric values

When trying to determine if a metric value is a reasonable estimate for a mass, length or other measurement, first convert all options to the most logical unit and eliminate outliers.

- Apply the methods for converting between powers, operations in SN, and knowledge of metric prefixes to solving problems.

Example: Which of the following is most likely the length of a school bus?

- a) 1×10^2 km b) 1×10^{-2} km c) 1×10^{-4} km d) 1×10^{-3} km

Convert to meters and eliminate answers that don't make sense

1×10^5 m **1×10^1 m** 1×10^{-1} m 1×10^0 m

100,000m **10m** 0.1m 1m

- Conversions between metric and English values are sometimes necessary. Keep these equivalencies in mind so you can relate metric value to common American measurement
 - 1 kilogram = 2.2 pounds
 - 1 inch = 2.54 cm = 0.0254 m
 - 1 foot = 30.5 cm = 0.305m
 - 1 meter = 39.4 inches = 1.093 yards
 - 1 kilometer = 0.621 miles or 1 mile = 1.609 km (ie 5 kilometers = 3.1 miles)

Example: Which of these is most likely the mass of a high school textbook?

- a) 2×10^0 kg b) 2×10^2 kg c) 2×10^{-4} kg d) 2×10^1 kg

$2 \times (2.2 \text{ lbs})$ $2 \times 100 \times 2.2 \text{ lbs}$ $2 \times (0.0001) \times (2.2 \text{ lbs})$ $2 \times 10 \times 2.2 \text{ lbs}$

4.4 lbs 440 lbs 0.00044 lbs 44 lbs

Skill 3: Factor Label Method (aka dimensional analysis)

In order to convert between measurement systems, use a system which arranges units of measurement so that they "simplify out" in order to keep track of operations with numbers.

- Make a list of equivalent relationships between values. Since both values in the equivalence are equal they can be set up as a "reversible fraction" equal to 1 that can be used to switch between units.
- Starting with "given" multiply by equivalents in the form of a fraction with units arranged so that you "divide out" what you don't want and "multiply into" what you do want.

For example:

To convert 30 mi/hour to m/s

- Make a list of equivalents between measurement systems
 - 1 mile = 1609 m
 - 1 hour = 3600 s

$$?\frac{m}{s} = 30 \frac{mi}{hr} \times \frac{1609 m}{1 mi} \times \frac{1 hour}{3600 s} = \frac{30 \times 1609 \times 1 m}{3600 s} = 13.4 \frac{m}{s}$$

Arrange units to "simplify out" of given units and "into" desired units. Then follow mathematical operations with numbers. Assign remaining units of measurement.