

## **Metric Conversions**

Here in the U.S. we use the “English” system of measurement. The international community uses the SI or Systeme International which is equivalent to the metric system. Even England has started the conversion to the SI system of measurement. Besides the U.S. only two other major countries retain the non-metric system; the two countries are Liberia and Burma.

The scientific community uses the metric system because of its simplicity and because all major countries except us have converted to it. The metric system allows ease of calculation because it is based on a system of 10. You either multiple or divide by 10 to convert between measurements.

It is useful for you to be familiar with both the “English” and metric systems since we still use the “English” system as a culture, but the rest of the world is operating on the metric system. Here are some useful conversions between the English and Metric or SI system.

When converting between systems dimensional analysis is useful. It is a way to set up a problem where you are sure to get the correct answer. It is also a useful way to attack word problems. There are many sources in the Internet that make conversions for you. They are good to use as a check. But to really understand and solve problems you need to understand the units of measurement you are using.

### **English    Metric**

**1 inch =2.54 centimeter(cm)**  
**1 Foot =0.3 meters**  
**1 yard =0.9 meters**  
**1 mile = 1.6 kilometers**  
**1 Kilogram(kg) = 2.2 pounds**  
**1 liter= 1.1 quarts**  
**1 gallon =3.79 liters**  
**12 inches= 1 foot**  
**3 feet= 1 yard**  
**5280 feet= 1 mile**

## Solving a Problem Using Dimensional Analysis

How many centimeters are equal to 12 inches?

$$\frac{12 \text{ inches}}{1.0 \text{ inch}} \times \frac{2.54 \text{ cm}}{1.0 \text{ inch}} = 30.48 \text{ cm}$$

When solving a problem using dimensional analysis, start with what you are given in the problem.

Decide what conversion factor should be used in the next step.

In the conversion factor step, place the unit on bottom that will cancel the unit in the previous step.

Proceed until you are left with the unit you are looking for.

Convert 30.48 cm to inches

$$\frac{30.48 \text{ cm}}{2.54 \text{ cm}} \times \frac{1.0 \text{ inch}}{1.0 \text{ inch}} = 12 \text{ in.}$$



Convert 3.0 lbs to kg.

$$\frac{3.0 \text{ lbs.}}{2.2 \text{ lbs.}} \times \frac{1.0 \text{ kg}}{2.2 \text{ lbs.}} = ? \text{ Kg.}$$

**Temperature Conversions** also pose a problem for the U.S. We use the Fahrenheit system while the rest of the world uses the Celsius scale. The Celsius scale is also referred to as the Centigrade scale.

**To convert from degrees Fahrenheit to degrees Celsius, subtract 32 degrees from the temperature and multiply by 0.56 (5/9).**

**To convert from degrees Celsius to degrees Fahrenheit, multiply the temperature by 1.8 and add 32 degrees.**

**Significant figures** reflect the limitations of our instruments. For example, it would be impossible to take a measurement of 1.89807 with a ruler. It would also be misleading to write a measurement as such since it implies a measurement we are unable to obtain

with a ruler. It is important to be honest when reporting a measurement, so that it does not appear to be more accurate than the equipment used. We can achieve this by controlling the number of digits, or **significant figures**, used to report the measurement. The number of significant figures in a measurement, such as 2.531, is equal to the number of digits that are known with some degree of confidence (2, 5, and 3) plus the last digit (1), which is an estimate or approximation. As we improve the sensitivity of the equipment used to make a measurement, the number of significant figures increases.

Postage Scale	$3 \pm 1$ g	1 significant figure
Two-pan balance	$2.53 \pm 0.01$ g	3 significant figures
Analytical balance	$2.531 \pm 0.001$ g	4 significant figures

Rules for counting significant figures are summarized below.

Zeros *within* a number are always significant. Both 4308 and 40.05 contain four significant figures.

Zeros that do nothing but set the decimal point are not significant. Thus, 470,000 has two significant figures.

Trailing zeros that aren't needed to hold the decimal point are significant. For example, 4.00 has three significant figures.

### Rounding Off

When the answer to a calculation contains too many significant figures, it must be rounded off.

There are 10 digits that can occur in the last decimal place in a calculation. One way of rounding off involves *underestimating* the answer for five of these digits (0, 1, 2, 3, and 4) and *overestimating* the answer for the other five (5, 6, 7, 8, and 9). This approach to rounding off is summarized as follows.

If the digit is smaller than 5, drop this digit and leave the remaining number unchanged. Thus, 1.684 becomes 1.68.

If the digit is 5 or larger, drop this digit and add 1 to the preceding digit. Thus, 1.247 becomes 1.25.

**For the problems in this lab we will only be concerned with rounding and the exercise will indicate if you need to round your answer to one or two decimal places.**

**Complete the following conversions. Please show your work for full credit.  
Round your answers to one decimal place.**

1. 14 centimeters equal how many inches?
2. 29 meters equal how many feet?
3. 175 kilometers equal how many miles?
4. 65 kilograms equal how many pounds?
5. 3 inches equal how many centimeters?
6. 4.3 feet equal how many meters?
7. 2000 feet equal how many miles?
8. 5000 feet equal how many kilometers?
9. 5 yards equal how many meters?
10. 10 gallons equal how many liters?

11. Complete the table by converting the following temperatures from Fahrenheit to Celsius. Round your answer to 1 decimal place. Show your work for the first calculation only. You may use the Internet for these calculations.

Fahrenheit	0	10	20	30	40	50	60	70	80	90	100
Celsius											

12. Complete the table by converting the following temperatures from Celsius to Fahrenheit. Round your answers to 1 decimal place. Show your work for the first calculation only.

Celsius	-10	-5	0	5	10	15	20	25	30	35	40
Fahrenheit											