

13 Unit Conversions

Unit conversions are a fact of life for Americans. We buy lumber in feet and inches, take a 50 cc shot, drink milk from a gallon jug but softdrinks from a 2-liter bottle, gain pounds of weight, and take 250 mg of aspirin for the resulting headache. Because of a units conversion error, NASA lost the \$125-million Mars Climate Orbiter. Units matter. See [\[here.\]](#)

Most scientists use the metric system. Most American engineers use the British system. Most of the rest of us need to be somewhat comfortable with both. This lab is intended to brush the dust off our skills in performing such conversions. A table of common conversions is attached, and more are available on the web, such as at <http://www.onlineconversion.com/>.

Technique

There are many ways to convert between metric and British numbers, but a method that always works is the old *multiplication by one* method. The idea behind this is simple:

- Always put equal measures one above the other, and
- Make sure all units cancel out except the one you are converting *to*.

For example, to convert from 3 feet to centimeters, we can use the fact that 1 foot = 12 inches and 1 inch equals 2.54 centimeters. We write it like this

$$\frac{3ft}{1ft} \frac{12in}{1in} \frac{2.54cm}{1in} = 91.44cm \quad (2)$$

The feet and inches cancel out, leaving only centimeters. In the process, we avoid getting confused about whether to multiply or divide.

When converting areas or volumes, remember the the conversion factor must be squared or cubed, too:

$$\frac{3ft^2}{1ft} \frac{12in}{1ft} \frac{12in}{1in} \frac{2.54cm}{1in} \frac{2.54cm}{1in} = 2787cm^2 \quad (3)$$

Note that $3ft^2$ is not the same as $(3ft)^2$

Useful Conversions

1m = 1000 mm	1m =100cm	1cm= 10 mm
1 km=1000 m	1 km= 0.62 mile	1 mile= 5280ft
7.48 gal = 1 ft ³	1 mL=1 cm ³	1000 mL=1 L
1 kg=1000 g	1 g=1000 mg	1 kg= 2.20 lb
1 oz (weight) = 28.35 g	1 oz (liquid) = 29.57 cm ³	1 newton = 0.225 lb-force
1 acre = 43,560 ft ²	1 mile ² = 640 acres	1 hectare = 10,000 m ²

Note: Does a 16oz soft drink weigh a pound?

Assigned Problems

Perform the following conversions or answer the questions. Show how you calculate your answers.

1. $10ft \longrightarrow cm$

2. $20cm \longrightarrow mm$

3. $20cm \longrightarrow m$

4. $25km \longrightarrow miles$

5. $15gal \longrightarrow ft^3$

6. $2kg \longrightarrow lbs$

7. $12oz(liquid) \longrightarrow cm^3$

8. $12oz(solid) \longrightarrow g$

9. If a parking lot is 100 feet by 100 feet, how many acres does it cover?

10. If a circle has a radius of 2in, what is its area in cm^2 ($A = \pi r^2$) ?
11. If a square has sides of length 7ft, what is its area in m^2 ? ($A = s^2$)
12. When you buy 2×6 lumber, the actual size is 1.5in by 5.5in. If you are building a deck that is 16ft by 16ft, how many 8-foot-long 2×6 boards would you need to buy?
13. Carpet used to be sold by the square yard. If your bedroom is 14ft × 14ft, how many square yards of carpet would you buy?

Out-of-Class Assignment

Extra Credit: As we'll see next week, the density of granite is approximately 2.75g/cm^3 . How big would a ton of solid granite be? Give your answer in cubic meters. For credit, show your work. Submit your answer at the beginning of next week's lab.