UNIT CONVERSIONS

In the field of science, the metric system is used in performing measurements. The metric system is actually easier to use than the English system, as you will see shortly. The metric system uses prefixes to indicate the magnitude of a measured quantity. The prefix itself gives the conversion factor. You should memorize some of the common prefixes, as you will be using them on a regular basis. Common prefixes are shown below:

Prefix	Symbol	Power	Prefix	Symbol	Power
mega-	M	10^6	centi-	c	10^{-2}
kilo-	k	10^3	milli-	m	10^{-3}
hecto-	h	10^2	micro-	μ	10^{-6}
deca-	D	10^1	nano-	n	10^{-9}
deci-	d	10^{-1}	pico-	p	10^{-12}

Metric - Metric Conversions

Suppose you wanted to convert the mass of a 250 mg aspirin tablet to grams. Start with what you know and let the conversion factor units decide how to set up the problem. If a unit to be converted is in the numerator, that unit must be in the denominator of the conversion factor in order for it to cancel.

$$\frac{250 \text{ mg}}{1} \times \frac{1 \times 10^{-3} \text{ g}}{1 \text{ mg}} = 0.250 \text{ g}$$

Notice how the units cancel to give grams. I've shown the conversion factor numerator as 1×10^{-3} because on most calculators, it must be entered in this fashion, not as just 10^{-3}. If you don't know how to use the scientific notation on your calculator, try to find out as soon as possible. Look in your calculator's manual, or ask someone who knows. Also, notice how the unit, mg is assigned the value of 1, and the prefix, milli-, is applied to the gram unit. In other words, 1 mg literally means 1×10^{-3} g.

Next, let's try a more involved conversion. Suppose you wanted to convert 250 mg to kg. You may or may not know a direct, one-step conversion. In fact, the better method (foolproof) to do the conversion would be to go to the base unit first, and then to the final unit you want. In other words, convert the milligrams to grams and then go to kilograms:

$$\frac{250 \text{ mg}}{1} \times \frac{1 \times 10^{-3} \text{ g}}{1 \text{ mg}} \times \frac{1 \text{ kg}}{1 \times 10^3 \text{ g}} = 2.5 \times 10^{-4} \text{ kg}$$

UNIT CONVERSIONS

English - Metric Conversions

These conversions are accomplished in the same way as metric - metric conversions. The only difference is the conversion factor used. It would be a good idea to memorize a few conversion factors involving converting mass, volume, length and temperature. Here are a few useful conversion factors:

length: 2.54 cm = 1 inch (exact)

mass: 454 g = 1 lb

volume: 0.946 L = 1 qt

temperature: $^oC = (^oF - 32)/1.8$

All of the above conversions are to three significant figures, except length, which is an exact number. As before, let the units help you set up the conversion.

Suppose you wanted to convert mass of my 23 lb cat to kilograms. One can quickly see that this conversion is not achieved in one step. The pound units will be converted to grams, and then from grams to kilograms. Let the units help you set up the problem:

$$\frac{23\ lb}{1} \times \frac{454\ g}{1\ lb} \times \frac{1\ kg}{1 \times 10^3\ g} = 10\ kg$$

Let's try a conversion which looks "intimidating", but actually uses the same basic concepts we have already examined. Suppose you wish to convert pressure of 14 lb/in^2 to g/cm^2. When setting up the conversion, worry about one unit at a time, for example, convert the pound units to gram units, first:

$$\frac{14\ lb}{in^2} \times \frac{454\ g}{1\ lb}$$

Next, convert in^2 to cm^2. Set up the conversion without the exponent first, using the conversion factor, 1 in = 2.54 cm. Since we need in^2 and cm^2, raise everything to the second power:

$$\frac{14\ lb}{in^2} \times \frac{454\ g}{1\ lb} \times \frac{1^2\ in^2}{2.54^2 cm^2} = 9.9 \times 10^2\ g/cm^2$$

Notice how the units cancel to the units sought. Always check your units because they indicate whether or not the problem has been set up correctly.