Converting from one unit to another

We will use the method of dimensional analysis, sometimes called the factor-label method.
... or, the "drag and drop" method!

Dimensional analysis uses conversion factors to change between one unit and another

What's a conversion factor? A simple equality.

Example

$12\ \text{in} = 1\ \text{ft}$

Conversion factors in metric

In the metric system, conversion factors between units may always be made from the metric prefixes!

For example, "kilo-" means 10^3

$$k = 10^3$$

so

$$km = 10^3 m$$

$$kg = 10^3 g$$

$$kL = 10^3 L$$

$$ks = 10^3 s$$

Just apply the prefix to the base unit!

How do we actually USE a conversion factor?

Convert 15.75 m to cm

$cm = 10^{-2} m$

$$15.75\ m \times \frac{cm}{10^{-2}\ m} = 1575\ cm$$

* Similar to...

If X = 2, then

$$\frac{X}{2} = 1$$

15.75 / EE −2 .. on TI-83

* This fraction equals one, so multiplying by it does not change the VALUE of the number, only its UNITS!

Convert 0.01893 kg to g

$kg = 10^{3} g$

$$0.01893\ kg \times \frac{10^{3} g}{kg} = 18.93\ g$$

DRAG AND DROP

- Drag the part of the factor that contains the unit you want to get rid of (cancel out) to the BOTTOM.

- Then, drag the other half of the factor to the TOP

Convert 14500 mg to kg

$mg = 10^{-3} g$ $\quad kg = 10^{3} g$

$$14500\ mg \times \frac{10^{-3}\ g}{mg} \times \frac{kg}{10^{3}\ g} = 0.0145\ kg$$

Tip: When writing conversion factors, don't use units that already have an exponent (like squared or cubed units).

Convert 0.147 cm^2 to m^2

$cm = 10^{-2} m$

$$0.147\ cm^2 \times \frac{10^{-2}\ m}{cm} \times \frac{10^{-2}\ m}{cm} = 1.47 \times 10^{-5}\ m^2$$

$(0.0000147\ m^2)$

When converting squared or cubed units, you'll need to use each factor two (squared) or three (cubed) times ... to cancel out each "copy" of the prefix:

$cm^2 = cm \times cm$ $\quad cm^3 = cm \times cm \times cm$

8.45 kg to μg

$Kg = 10^{3} g \qquad \mu g = 10^{-6} g$

$$8.45\,Kg \times \frac{10^{3} g}{Kg} \times \frac{\mu g}{10^{-6} g} = 8450000000\,\mu g$$

$(8.45 \times 10^{9}\,\mu g)$

88100 kHz to MHz

$Hz = s^{-1}$ (Frequency)

$kHz = 10^{3} Hz \qquad MHz = 10^{6} Hz$

$$88100\,kHz \times \frac{10^{3} Hz}{kHz} \times \frac{MHz}{10^{6} Hz} = 88.1\,MHz$$

Convert 38.47 in to m, assuming 2.54 cm = 1 in

$2.54\,cm = 1\,in \qquad cm = 10^{-2}\,m$

$$38.47\,in \times \frac{2.54\,cm}{1\,in} \times \frac{10^{-2}\,m}{cm} = 0.9771\,m$$

Convert 12.48 km to in $\qquad 2.54\,cm = 1\,in \qquad cm = 10^{-2}\,m \qquad km = 10^{3}\,m$

$$12.48\,km \times \frac{10^{3}\,m}{km} \times \frac{cm}{10^{-2}\,m} \times \frac{in}{2.54\,cm} = 491300\,in$$