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

$kg = 10^3 g$

$kL = 10^3 L$

$km = 10^3 m$

$ks = 10^3 s$

Just apply the prefix to the base unit!

How do we actually USE a conversion factor?

Convert 15.75 m to cm

$1\text{ cm} = 10^{-2}\text{ m}$

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

* 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

$1\text{ Kg} = 10^{3}\text{ g}$

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

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

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

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

Convert 0.147 cm^2 to m^2

$cm = 10^{-2} m$

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

$(0.0000147\ m^2)$

When making conversion factors from prefixes, you must use units that DON'T already have an exponent!

Note: For squared or cubed units, you will use each conversion factor two (squared) or three (cubed) times! It makes senses if you remember:

$cm^2 = cm \cdot cm$

$cm^3 = cm \cdot cm \cdot cm$

8.45 kg to μg

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

$$8.45\,Kg \times \frac{10^{3}\,g}{Kg} \times \frac{\mu g}{10^{-6}\,g} = 8450000000\,\mu g \quad (8.45 \times 10^{9}\,\mu g)$$

88100 kHz to MHz

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

$KHz = 10^{3} Hz$

$MHz = 10^{6} Hz$

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

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

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

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

Convert 12.48 km to in

$2.54\,cm = in \qquad cm = 10^{-2}\,m \qquad Km = 10^{3}\,m$

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

Accuracy and Precision

- two related concepts that you must understand when working with measured numbers!

Accuracy

- how close a measured number is to the CORRECT (or "true") value of what you are measuring

- "Is it right?"

- checked by comparing measurements against a STANDARD (a substance or object with known properties)

Precision

- how close a SET of measured numbers are to EACH OTHER

- "Can I reproduce this?"

- checked by repeated measurements