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 in = 1 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

$$km = 10^3 m$$

$$kL = 10^3 L$$

$$kg = 10^3 g$$

$$ks = 10^3 s$$

Just apply the prefix to the base unit!

How do we actually USE a conversion factor?

Convert 15.75 m to cm

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

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

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

* Similar to...

If X = 2, then

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

$15.75 / \boxed{EE} -2$ .. on TI-83

Convert 0.01893 kg to g

$kg = 10^{3}\,g$

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

DRAG AND DROP

- Drag the part of the factor that you want to cancel out to the BOTTOM.
- Then, drag the other half of the factor to the TOP

Convert 14500 mg to kg

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

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

Convert 0.147 cm^2 to m^2

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

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

For squared units, we have to convert BOTH parts of the unit, so we use each conversion factor twice. If you think of a squared unit as

$$cm^2 = cm \times cm$$

... then using each factor twice should make sense. (For cubed units, use each factor THREE times!)

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

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

Hz = 1/s (frequency)

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

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 $\quad 2.54\ cm = in \qquad km = 10^{3} m \qquad cm = 10^{-2} m$

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

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