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
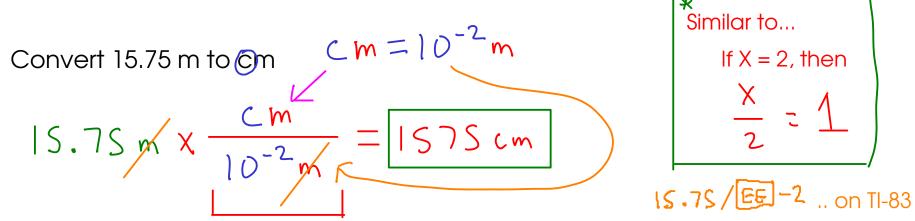
What's a conversion factor? A simple equality.

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

$$Km = 10^3 m$$

$$KL = 10^3 L$$

$$Kg = 10^3 g$$

$$Ks = 10^3 s$$

Just apply the prefix to the base unit!

How do we actually USE a conversion factor?

Convert 15.75 m to cm

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

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

Similar to...

If X = 2, then

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

$15.75 / \boxed{EE} -2$ .. 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 <u>kg</u> to g

$$kg = 10^3 g$$

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

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

$$mg = 10^{-3} g$$

$$Kg = 10^3 g$$

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

Convert 0.147 cm^2 to m^2

Don't square or cube the units IN the factor

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

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

$$(0.00000147 \; m^2)$$

For squared and cubed units, use each conversion factor two (squared) or three (cubed) times. Think of squared units this way:

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

... and it'll make sense!

8.45 kg to μg

$$Kg = 10^3 g$$

$$\mu g = 10^{-6} g$$

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

$$\left(8.45 \times 10^9 \, \mu g \right)$$

88100 kHz to MHz

$$KHz = 10^3 Hz$$

$$MHz = 10^6 Hz$$

$$Hz = S^{-1} \, (frequency)$$

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

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

$2.54 \, cm = in$

$cm = 10^{-2} m$

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

Convert 12.48 km to in

$2.54 \, cm = in$

$km = 10^3 \, m$

$cm = 10^{-2} m$

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

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