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

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

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

$cm = 10^{-2} m$

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

* Similar to...

If X = 2, then

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

* 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

$kg = 10^{3} g$

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

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

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

Convert 0.147 cm^2 to m^2 $\quad cm = 10^{-2}\,m$

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

$(0.0000147\,m^2)$

We have to convert BOTH PARTS of the squared unit, so we use the factor TWICE.

$cm^2 = cm \times cm$

For CUBED units, apply the factors THREE times.

8.45 kg to mg

$kg = 10^3 g$ $\quad$ $mg = 10^{-6} g$

$$8.45\,kg \times \frac{10^3 g}{kg} \times \frac{mg}{10^{-6} g} = \boxed{\begin{array}{l} 8450000000\,mg \\ 8.45 \times 10^9\,mg \end{array}}$$

88100 kHz to MHz

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

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

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

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

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

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

$Km = 10^{3} m$

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

$4.913 \times 10^{5}\ in$

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