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

$$kg = 10^3 g$$

$$km = 10^3 m$$

$$ks = 10^3 s$$

$$kL = 10^3 L$$

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

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

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

$Kg = 10^3 g$

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

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

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

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

Tip: When making a factor from a prefix, do not use squared or cubed units as a base. Use a base without an exponent!

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

$(0.0000147\,m^2)$

For squared or cubed units, apply each factor two (for squared) or three (for cubed) times. If you remember that

$$cm^2 = cm \times cm \quad \text{and} \quad cm^3 = cm \times cm \times cm$$

... then it should make sense.

8.45 kg to μg

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

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

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

88100 kHz to MHz

$\boxed{Hz = s^{-1}\ (\text{frequency})}$

$kHz = 10^3 Hz$

$MHz = 10^6 Hz$

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

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

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

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

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

$km = 10^{3}\,m$

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