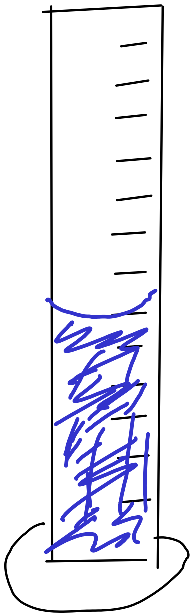
...of an object

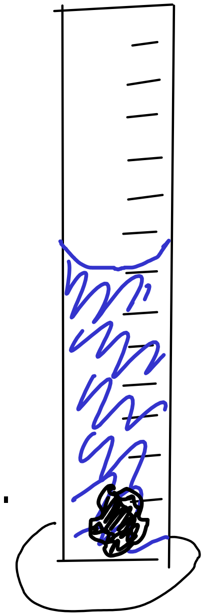
1) Measure mass of object

mass = 9.78 g



2) Partially fill cylinder with liquid, record volume.

volume = 25.0 mL



3) Put object into cylinder, record new volume

volume = 26.6 mL

4) Subtract to find volume of object

$$\begin{array}{r l} 26.6 & \text{mL} \\ -\ 25.0 & \text{mL} \\ \hline 1.6 & \text{mL} \end{array}$$

5) Density = mass object / volume object

$$\text{Density} = \frac{9.78\ \text{g}}{1.6\ \text{mL}}$$

$$\boxed{= 6.1\ \text{g/mL}}$$

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

$$km = 10^3 m$$

$$ks = 10^3 s$$

$$kL = 10^3 L$$

$$kg = 10^3 g$$

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

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

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

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

$0.0000147\,m^2$

For squared and cubed units, you'll need to apply each factor two (squared) or three (cubed) times. Remember that squared and cubed units are really

$cm^2 = cm \times cm$ $cm^3 = cm \times cm \times cm$

... and it'll make more 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

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

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

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