Measuring density
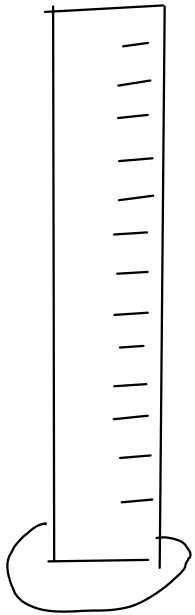
... of a liquid

1) Measure mass of empty cylinder

mass = 97.35 g

2) Fill cylinder and measure volume of liquid

volume = 25.3 mL

3) Measure mass of filled cylinder

mass = 130.55 g

4) Subtract to find mass of liquid

$$130.55 \text{ g}$$
$$- 97.35 \text{ g}$$
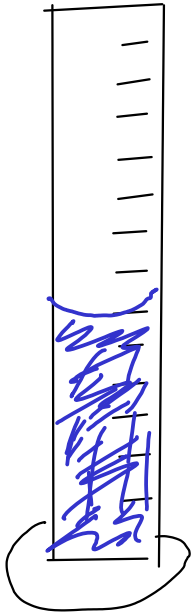$$\overline{ 33.20 \text{ g}}$$

5) Density = mass liquid / volume liquid

$$\text{Density} = \frac{33.20 \text{ g}}{25.3 \text{ mL}}$$
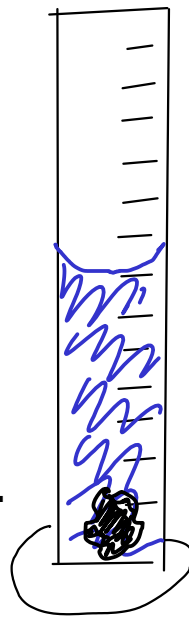
$$= 1.31 \text{ g/mL}$$

...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

$$26.6 \text{ mL} - 25.0 \text{ mL} = 1.6 \text{ mL}$$

5) Density = mass object / volume object

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

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

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

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

$$Kg = 10^3 g$$

$$Km = 10^3 m$$

$$Ks = 10^3 s$$

$$KL = 10^3 L$$

Just apply the prefix to the base unit!

How do we actually USE a conversion factor?

Convert 15.75 m to cm

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

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

* 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 0.0183 kg to g

$$Kg = 10^3 g$$

$$0.0183 \, Kg \times \frac{10^3 g}{Kg} = \boxed{18.3 g}$$

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

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

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

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

Convert 0.147 cm² to m²

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

$$0.0000147 \, m^2$$

Tip!

When making conversion factors from metric prefixes, the base you apply to each side can't have its own exponent!

When converting squared or cubed units, use each factor two (for squared) or three (for cubed) times.

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