We will use the method of <u>dimensional analysis</u>, 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.

Conversion factors in metric

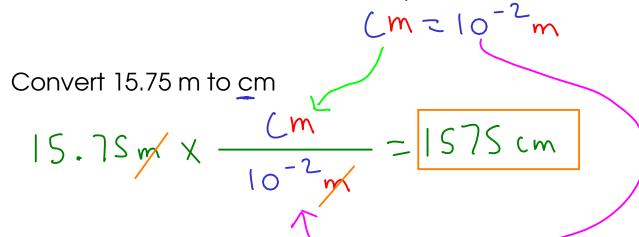
In the metric system, conversion factors between units may always be made from the metric prefixes!

For example, "
$$K_{10}$$
" means 10^{3}
 $K = 10^{3}$

So

 $K_{g} = 10^{3}$
 $K_{m} = 10^{m}$
 $K_{m} = 10^{3}$
 $K_{m} = 10^{3}$

How do we actually USE a conversion factor?



DRAG **AND** DROP!

Put what you want to cancel on the bottom, then ...

... put what it equals on the top!

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

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

$$kg = 10^3 g$$

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

If you have TWO prefixes in your problem, you will apply TWO conversion factors in your solution!

Convert 0.147 mm to μ m

$$mm = 10^{-3}$$
 $n = 10^{-6}$

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

$$2.54 cm = 10$$
 $cm = 10^{-2} m$

Even though English units are involved, we can solve this problem the same way we solved the previous problem where only metric units were used!

²⁰ Even if you're unfamiliar with the metric units involved in a problem, you can still do conversions easily.

88100 kHz to MHz
$$H_{z} = 5^{-1}$$
 (frequency)

 $KH_{z}=10^{3}H_{z}$ $MH_{z}=10^{6}H_{z}$
 $88100 KH_{z} \times \frac{10^{3}H_{z}}{KH_{z}} \times \frac{MH_{z}}{10^{6}H_{z}} = 88.1 MH_{z}$

A sample application of dimensional analysis: Drug calculations.in the healthcare field.

Example: A patient is ordered 40 mg of codeine phosphate by subcutaneous injection. 50 mg in 1 mL liquid is available. How much of this liquid should be adminstered?

This is a conversion factor. It tells us the volume of liquid that contains a certain amount of the drug. We can use this information exactly the same way we were using the metric prefixes earlier!

Hint: Many statements that give conversion factors contain the words "in" or "per"!

$$50 \text{ mg drvg} = 1 \text{ mL}$$

$$40 \text{ mg drvg} \times \frac{1 \text{ mL}}{50 \text{ mg drvg}} = 0.8 \text{ mL}$$

Mileage

A car (averaging 17.5 miles per gallon) is traveling 50 miles per hour. How many gallons of gas will be used on a trip that lasts 0.75 hours?

17.5 mi = gal 50 mi = hr
0.75 hr x
$$\frac{50 \text{ mi}}{\text{hr}}$$
 y $\frac{\text{gal}}{17.5 \text{ mi}}$ = $\frac{2.1 \text{ gal}}{2.1 \text{ gal}}$

If gas is \$3.46 per gallon, how much will the trip cost?

$$2.1 \text{ gal } \times \frac{\$3.46}{\text{gal}} = \$7.41$$

For a 200 mile trip in a car which averages 15 miles per gallon, if gas costs \$3.46 per gallon, what's the cost of the trip?

15mi = gal \$3.46 = gal

200 mi x
$$\frac{gal}{15mi}$$
 x $\frac{$3.46}{gal}$ = \$46.13