N2 – Dimensional Analysis
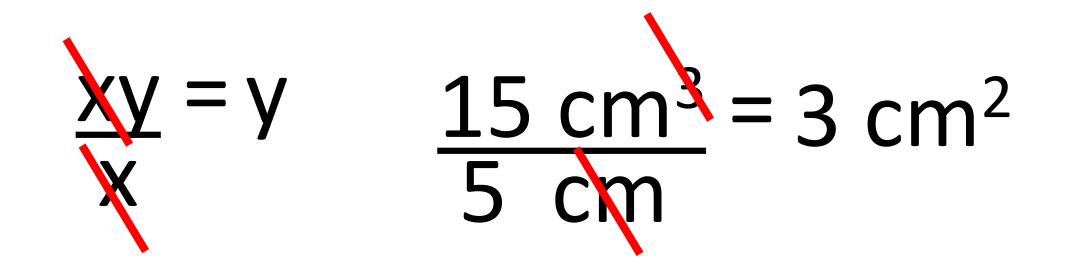
Also known as "Unit Conversion"

Target: I can use dimensional analysis to convert not just the numbers in a measurement but also the units

Link to YouTube Presentation: https://youtu.be/fhj5d5zZa-4

<u>Remember - Canceling Units</u>

One on top cancels with one on the bottom

$$\frac{\cancel{x}y}{\cancel{x}} = y \qquad \frac{15 \text{ cm}^{\cancel{3}}}{5 \text{ cm}} = 3 \text{ cm}^2$$

Conversion Factors

A relationship between how many of one thing equals how many of another thing

12in = 1ft   **24hrs = 1,440min**   **1000m = 1km**

You can rewrite as fractions:

$$\frac{12\text{in}}{1\text{ft}} = 1 \qquad \frac{24\text{hr}}{1,440\text{min}} = 1 \qquad \frac{1\text{km}}{1000\text{m}} = 1$$

Conversion Factors

You can flip conversion factors too

12in = 1ft   24hrs = 1,440min

Just depends on what you are doing

Using Conversion Factors

If you multiply by a conversion factor, you are just multiplying by 1...your answer LOOKS DIFFERENT because of the unit but is the same SIZE MEASURMENT. (12in/1ft or 1ft/12in)

$$85 \; inches \; x$$

Using Conversion Factors

You can use multiple conversion factors –
"a frog hopping across a pond on lily pads"

Convert 3.6mi into cm.

(1cm=0.3937in, 12in=1ft, 1mi=5,280ft)

You try one...

Convert 15years into minutes

$$15yrs \; x \frac{365days}{1\,yr} \; x \frac{24hrs}{1\,day} \; x \frac{60min}{1hr} = 7.9x10^{6}min$$

Line Method

Keeps work neat, tidy, takes less space, easier to grade, a very typical way to show conversions in chemistry. I will always use the line method!

Convert 15years into minutes

$$15yrs \ x\frac{365days}{1\ yr}x\frac{24hrs}{1\ day}\ x\frac{60min}{1hr}=7.9x10^6min$$

Dimensional Analysis with "Derived/Double Units"

Some units are combinations of two or more other units. Like miles per hour (mi/hr). Fix the top unit, then go back and fix the bottom unit

Convert 20mi/hr into in/sec.

You try one...

Convert 30km/day into ft/min   (1m=39.37in)

You try one...

Convert 30km/day into ft/min   (1m=39.37in)

$$\frac{30km}{1day} \cdot \frac{1000m}{1km} \cdot \frac{39.37in}{1m} \cdot \frac{1foot}{12in} \cdot \frac{1day}{24hr} \cdot \frac{1hr}{60min}$$

$$= 68.4 \frac{ft}{min}$$

Dimensional Analysis - Squared, Cubed (etc) Units

If you have a unit that is raised to a power, then the conversion factors used will also need to be raised to that power. The number AND the unit.

1 in = 2.54cm but $1in^2 = (2.54cm)^2$

1 ft = 12in but $1ft^3 = (12in)^3$

$$\frac{5in^2 \quad (2.54cm)^2}{(1in)^2} = 32.258 \ cm^2$$

YouTube Link to Presentation

- https://youtu.be/fhj5d5zZa-4