

GENERAL CHEMISTRY

STANDARD 1.8

DIMENSIONAL ANALYSIS

- A tool for unit conversion
- A process for converting units
- Requires organization
- Example Dimensional Analysis Setup
 - Convert 500 nm to km
 - Always start with the known quantity (500 nm in this case)
 - The unit of the known quantity (nm in this case) starts on the bottom of the dimensional analysis
 - The desired unit for conversion goes on top, with repeating of this process until the final unit is achieved.
 - Multiply by numbers on top, divide by numbers on bottom

$$\frac{900 \text{ nm}}{1 \text{ nm}} \times \frac{10^{-9} \text{ m}}{1 \text{ nm}} \times \frac{1 \text{ km}}{10^3 \text{ m}} = 9 \times 10^{-10} \text{ km}$$

DIMENSIONAL ANALYSIS

- Each column in the table is called a conversion factor
 - A conversion factor is numerically equal to one
 - A conversion factor changes the units
 - A conversion factor cannot change significant figures
 - Significant figures are determined by initial measurement

DIMENSIONAL ANALYSIS EXAMPLE

Convert 3.45 deciliters to hectoliters, and find the price of 3.45 dl of oil if the price is \$205 per hectoliter.

Start with the initial value, 3.45 deciliters.

HINT: Any time you see the word “per” think divide...per means divide. Divide means conversion factor.

$$\frac{3.45 \text{ dl}}{1 \text{ dl}} \times \frac{10^{-1} \text{ L}}{1 \text{ L}} \times \frac{1 \text{ hL}}{10^2 \text{ L}} \times \frac{\$205}{1 \text{ hL}} = \$0.71$$

DIMENSIONAL ANALYSIS AREA

EXAMPLE

Convert 2500 square decimeters to square meters

Here, it is possible to square an entire conversion factor, which means to complete the conversion factor *twice*:

$$\frac{2500 \text{ dm}^2}{1} \times \frac{10^{-1} \text{ m}}{1 \text{ dm}}^2 = 25 \text{ m}^2$$

Mathematically, this looks like $2500 \times 10^{-1} \times 10^{-1} = 25$

The same holds true for cubic conversion factors (volume)