DIMENSIONAL ANALYSIS

What is Dimensional Analysis

It is a technique used to convert from one unit to another. It can be used for metric to metric, metric to English, or English to metric units.

It is used extensively in chemistry to convert between grams, moles, and particles!

It is based on a pattern, just like dominoes!

Dimensional Analysis uses Fractional Conversion Factors

- A conversion factor is an equality that relates two different units of measure
- Ex. 1 dozen = 12 objects
- Ex. 4.814 joules = 1 calorie
- Ex. $1.10 US dollars = 1 Euro
- Ex. 1 meter = 1000 millimeters

- Conversion factors can be written as fractions having a value of “1”.

Try this one….

- 7 triangles = 5 squares
- 12 circles = 8 triangles
- 6 ovals = 4 circles
- 4 diamonds = 2 squares

- So, 25 diamonds = _____ ovals?

Of course…we will use DA to convert real units

Remember – Length can only be converted to length.

Volume can only be converted to volume.

Mass (weight) can only be converted to mass (weight).

Time can only be converted to time.

If you need a metric-metric conversion factor, you will need to make it yourself by using the metric staircase.

For example = 1 L = _____ kL

Now try a problem with real units…..

2 m = _____ feet?

STEP 1

Obtain a list of conversion factors (facts that help you convert). See p. 3 of your packet:

1 m = 100 cm

1 inch = 2.54 cm

1 foot = 12 inches

STEP 2

Draw a sideways “t”, and put what you are starting with in the upper left corner.

Note: The bottom left corner often remains blank.

STEP 3

1 m = 100 cm
1 inch = 2.54 cm
1 foot = 12 inches

Write your conversion factors as fractions, and arrange these fractions so that old **units cancel**...and you get the units you want! Remember, each fraction has a value of one so you are multiplying by "1".

$$\frac{2\ \text{m}}{1\ \text{m}} \quad \frac{100\ \text{cm}}{}$$

Note: The units cancel, but the numbers do not!

STEP 3

1 m = 100 cm
1 inch = 2.54 cm
1 foot = 12 inches

Write your conversion factors as fractions, and arrange these fractions so that old **units cancel**...and you get the units you want! Remember, each fraction has a value of one so you are multiplying by "1".

$$\frac{2\ \text{m}}{\ } \quad \frac{100\ \text{cm}}{1\ \text{m}} \quad \frac{1\ \text{in}}{2.54\ \text{cm}}$$

Note: The units cancel, but the numbers do not!

STEP 3

1 m = 100 cm
1 inch = 2.54 cm
1 foot = 12 inches

Write your conversion factors as fractions, and arrange these fractions so that old **units cancel**...and you get the units you want! Remember, each fraction has a value of one so you are multiplying by "1".

$$\frac{2\ \text{m}}{} \left| \frac{100\ \text{cm}}{1\ \text{m}} \right| \frac{1\ \text{in}}{2.54\ \text{cm}} \left| \frac{1\ \text{ft}}{12\ \text{in}} \right| = $$

Note: The units cancel, but the numbers do not!

STEP 4

Multiply the top through, and divide by the bottom on your calculator….

$$\frac{2\ \text{m} \quad 100\ \text{cm} \quad 1\ \text{in} \quad 1\ \text{ft}}{1\ \text{m} \quad 2.54\ \text{cm} \quad 12\ \text{in}} = \frac{(2)(100)}{(2.54)(12)}$$

Your answer should have the same number of sig. figs. as the **starting** measurement. Conversion factors have infinite sig. figs and do not limit you.

$$= 6.56\text{ft}$$

$$= \mathbf{7\ ft}$$

Converting Derived Units

- Convert: 60 mi/hr = _____ km/day?

Another example

- Convert: 0.045 g/L = _____ oz/fl.oz