Dimensional Analysis

Factor Label Method

| English Unit | SI Unit | Relationship |
|---------------------|------------|-------------------|
| Mile | Kilometer | 1 mile = 1.609 Km |
| Foot | Meter | 1 ft = .305 M |
| Inch | Centimeter | 1 inch = 2.54 Cm |
| Pound | Grams | 1 lb = 453.59 G |
| Ounce | Grams | 1 oz = 28.35 G |
| Gallon | Liter | 1 gallon = 3.79 L |

Math practice for DA:

$$7 \times {}^{3}/_{4} = ?$$

set up as fractions:

$$\frac{7}{1} \times \frac{3}{4} = \frac{21}{4} = 5.25$$

try one more:

$$12 \times \frac{7}{24} = ?$$

$$\frac{12}{1} \times \frac{7}{24} = \frac{84}{24} = 3.5$$

or factor out (simplify) first

$$\frac{12}{1} \times \frac{7}{24} = \frac{7}{2} = 3.5$$

We can also factor out labels or units

63 in. X 1 ft./12 in.

$$\frac{63 \text{ inf.}}{1} \times \frac{1 \text{ ft}}{12 \text{ inf.}} = \frac{63}{12} \text{ ft} = 5.25 \text{ ft}$$

Steps to Dimensional Analysis

1. Define the "given" and "goal"

Ex. Problem:

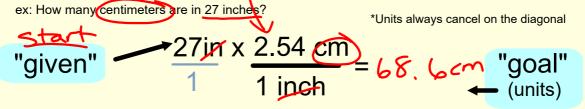
How many centimeters are in 27 inches?

2. Identify relationship between these.

$$2.54 \text{ cm} = 1 \text{ inch}$$

3. Arrange relationship into two possible conversion factors

4. Pick a conversion factor so units will cancel



or

chemists use "picket fence"

$$\frac{27 \text{ jm.}}{1 \text{ lineh}} = 68.6 \text{ cm}$$

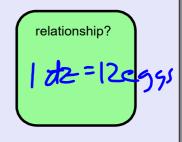
Why does this work? (conversion)

12 x 754 12

$$12 \times \frac{754}{754} = 12$$

$$12 \times 1 = 12$$

How many eggs in 4.75 dozen?



How many feet in 4 meters?

relationship: 1 foot = 0.305 meters

Solve with dimensional analysis

relationship: 1000 mm = 1 m



2 step DA - try it! > M > How many feet in a 850 centimeters?

relationship: 1 foot = 0.305 meters

relationship: 1 meter = 100 cm

patterns...

What 2 patterns are present? Solve it.

Convert 35 meters to miles.

$$\frac{35 \, \text{m}}{100 \, \text{cm}} \, \frac{1 \, \text{in}}{1 \, \text{in}} \, \frac{1 \, \text{ft}}{12 \, \text{in}} \, \frac{1 \, \text{mile}}{5280 \, \text{ft}} = \frac{35 \, \text{miles}}{100 \, \text{cm}} = \frac{35 \, \text{mil$$

- 1. Cross out units that cancel above. diagonal
- 2.Describe the relationship of top and bottom number: (top must = bottom in each section)

How many moles in 57.3g of Al?

How many grams in 32.3 mol Al?

How many atoms are in 32.3 mol?