Dimensional Analysis Problem Solving

Goals:

- under standing what equals, “=“ , means;
  the equal sign means “the same as”;
- identifying conversion “equivalent” statements used in Factor-Label Method Approach to Dimensional Analysis Problem Solving
- Performing Dimensional Analysis Problem Solving

Lets work out the dimensional analysis problems in the supplement packet togehter

a. ?? x kg = 420 g x _____ = _____

b. ?? x Mg = 0.000719 g x _____ = _____

c. ?? xcl = 22.6 Ml x _____ x _____ = _____

d. ?? xnm = 2660 µm x _____ x _____ = _____

e. ?? x dg = 0.75 mg x _____ x _____ = _____

? kg = 420 g

How many kilograms are the same as 420 grams?

In other words, convert 420 grams to kilograms

1. Begin by writing down conversion factors and their ratios.

$1\ kg = 10^3\ g$ $\qquad \frac{10^3\ g}{1\ kg}$ or $\frac{1\ kg}{10^3\ g}$

2. Choose conversion factors that cancels the units we want to discard and leaves the units we want in the result

$$? \text{ kg} = 420\ \cancel{g} \times \frac{1\ kg}{10^3\ \cancel{g}} = 4.2 \times 10^{-1}\ kg$$

? Mg = 0.000719 g

How many Megagrams are the same as 0.000719 grams?

In other words, convert 0.000719 grams to Megagrams.

1. Begin by writing down conversion factors and their ratios.

$1\ Mg = 10^6 g$ $\qquad \frac{10^6\ g}{1\ Mg}$ or $\frac{1\ Mg}{10^6\ g}$

2. Choose conversion factors that cancels the units we want to discard and leaves the units we want in the result

$$? \text{ Mg} = 0.000719\ \cancel{g} \times \frac{1\ Mg}{10^6\ \cancel{g}} = 7.19 \bullet 10^{-10}\ Mg$$

? cL = 22.6 ML

How many Megaliters are the same as 22.6 centiliters?

In other words, convert 22.6 centiliters to Megaliters.

1. Begin by writing down conversion factors and their ratios.

$1\ M\ L = 10^6 L$	$\frac{10^6\ L}{1\ M\ L}$	or	$\frac{1\ M\ L}{10^6\ L}$
$1\ c\ L = 10^{-2} L$	$\frac{10^{-2}\ L}{1\ cL}$	or	$\frac{1\ cL}{10^{-2}\ L}$

2. Choose conversion factors that cancels the units we want to discard and leaves the units we want in the result

$$\text{? cL} = 22.6\ \cancel{ML} \times \frac{10^6\ \cancel{L}}{1\ \cancel{ML}} \times \frac{1\ cL}{10^{-2}\ \cancel{L}} = 2.26\ EE\ 9\ cL$$

? nm = 2260 µm

How many nanometer are the same as 2260 micrometers?

In other words, convert 2260 micrometers to nanometers.

1. Begin by writing down conversion factors and their ratios.

$1\ \mu m = 10^{-6} m$	$\frac{10^{-6} m}{1\ \mu m}$	or	$\frac{1\ \mu m}{10^{-6} m}$
$1\ nm = 10^{-9}\ m$	$\frac{10^{-9}\ m}{1\ nm}$	or	$\frac{1\ nm}{10^{-9}\ m}$

2. Choose conversion factors that cancels the units we want to discard and leaves the units we want in the result

$$\text{? nm} = 2660\ \cancel{\mu m} \times \frac{10^{-6}\ \cancel{m}}{1\ \cancel{\mu m}} \times \frac{1\ nm}{10^{-9}\ \cancel{m}} = 2.66\ EXP\ 6\ nm$$

? ds = 0.75 ms

How many deciseconds are the same as 0.75 milliseconds?

In other words, convert 0.75 milliseconds to deciseconds.

1. Begin by writing down conversion factors and their ratios.

$1\ ms = 10^{-3} s$	$\frac{10^{-3} s}{1\ ms}$	or	$\frac{1\ ms}{10^{-3} s}$
$1\ ds = 10^{-1} s$	$\frac{10^{-1} s}{1\ ds}$	or	$\frac{1\ ds}{10^{-1} s}$

2. Choose conversion factors that cancels the units we want to discard and leaves the units we want in the result

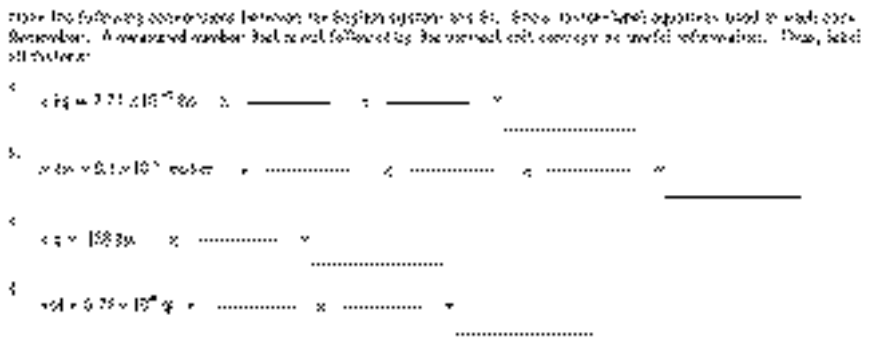
$$? \text{ ds} = 0.75 \cancel{\text{ms}} \times \frac{10^{-3} \cancel{s}}{1 \cancel{\text{ms}}} \times \frac{1 \text{ ds}}{10^{-1} \cancel{s}} = 7.5 \bullet 10^{-3} \text{ ds}$$

Think Metric…or Else!

8. Complete: 1 inch = 2.54 cm; 1 qt = 0.946 L; 1 lbs = 454 g (MEMORIZE THESE)

Memorize these equivalent statements for English to Metric conversions

Lets work out the dimensional analysis problems in the supplement packet togehter



? kg = 7.71×10^{-7} lbs

How many kilograms are the same as 7.71×10^{-7} pounds?

In other words, convert 7.71×10^{-7} pounds to kilograms.

1. Begin by writing down conversion factors and their ratios.

1 lbs = 454 g	$\frac{454\ g}{1\ lbs}$	or	$\frac{1\ lbs}{454\ g}$
1 kg = 10^3 g	$\frac{10^3\ g}{1\ kg}$	or	$\frac{1\ kg}{10^3\ g}$

2. Choose conversion factors that cancels the units we want to discard and leaves the units we want in the result

? kg = 7.71×10^{-7} ~~lbs~~ x $\frac{454\ \cancel{g}}{1\ \cancel{lbs}}$ x $\frac{1\ kg}{10^3\ \cancel{g}}$ = 3.50×10^{-7} kg

? dm = 8.1×10^3 inches

How many decimeters are the same as 8.1×10^3 inches?
In other words, convert 8.1×10^3 inches to decimeters.

1. Begin by writing down conversion factors and their ratios.

1 inch = 2.54 cm	$\frac{2.54\ \text{cm}}{1\ \text{inch}}$	or	$\frac{1\ \text{inch}}{2.54\ \text{cm}}$
1 cm = 10^{-2} m	$\frac{10^{-2}\ \text{m}}{1\ \text{cm}}$	or	$\frac{1\ \text{cm}}{10^{-2}\ \text{m}}$
1 dm = 10^{-1} m	$\frac{10^{-1}\ \text{m}}{1\ \text{dm}}$	or	$\frac{1\ \text{dm}}{10^{-1}\ \text{m}}$

2. Choose conversion factors that cancels the units we want to discard and leaves the units we want in the result

$$? \text{ dm} = 8.1 \times 10^3 \cancel{\text{ inches}} \times \frac{2.54\ \cancel{\text{cm}}}{1\ \cancel{\text{in}}} \times \frac{10^{-2}\ \cancel{\text{m}}}{1\ \cancel{\text{cm}}} \times \frac{1\ \text{dm}}{10^{-1}\ \cancel{\text{m}}} = 2.1 \cdot 10^3\ \text{dm}$$

? g = 136 lbs

How many grams are the same as 136 pounds?

In other words, convert 136 pounds to grams.

1. Begin by writing down conversion factors and their ratios.

1 lbs = 454 g	$\frac{454\ \text{g}}{1\ \text{lbs}}$	or	$\frac{1\ \text{lbs}}{454\ \text{g}}$

2. Choose conversion factors that cancels the units we want to discard and leaves the units we want in the result

$$? \text{ g} = 136\ \cancel{\text{lbs}} \times \frac{454\ \text{g}}{1\ \cancel{\text{lbs}}} = 6.17\ \text{EE}\ 4\ \text{g}$$

? cL = 6.70×10^4 qt

How many centiliters are the same as 6.70×10^4 quarts?

In other words, convert 6.70×10^4 quarts to centiliters.

1. Begin by writing down conversion factors and their ratios.

1 qt = 0.946 L	$\frac{0.964\ L}{1\ qt}$	or	$\frac{1\ lbs}{0.946\ L}$
1 cL = 10^{-2} L	$\frac{10^{-2} L}{1\ cL}$	or	$\frac{1\ cL}{10^{-2} cL}$

2. Choose conversion factors that cancels the units we want to discard and leaves the units we want in the result

? cL = 6.70×10^4 ~~qt~~ $\times \frac{0.946\ \cancel{L}}{1\ \cancel{qt}} \times \frac{1\ cL}{10^{-2}\ \cancel{L}}$ = 6.34 EXP 6 cL