Chapter 1.6 Dimensional Analysis

Tables of Conversion factors

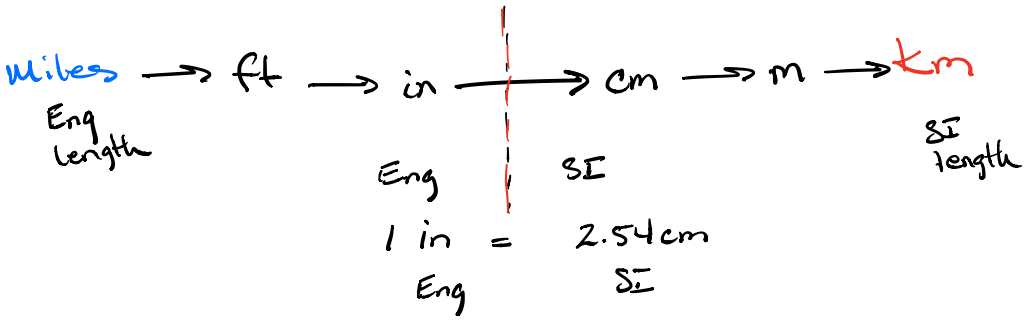
Table 1.6 has 12 conversion factors

3 keys ⇒ 3 key Conversion factors

* Please Memorize these three

	English		SI	
Length	1 in	=	2.54 cm (exact)	Def
Mass	1 lb	=	453.6 g (4 sf)	measured
Volume	1 gal	=	3.785 L (4 sf)	measured

ex Convert 3.75 miles into km.
(1 mi = 5280 ft)



3

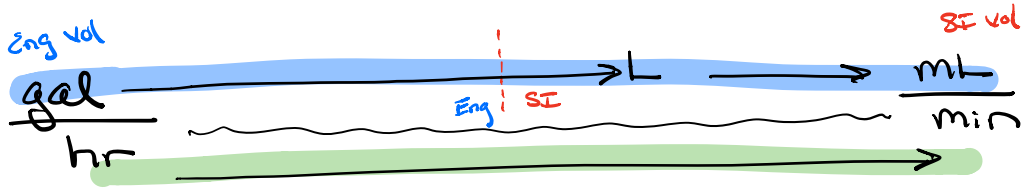
$$3.75 \text{ miles} \times \frac{5280 \text{ ft}}{1 \text{ mile}} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{2.54 \text{ cm}}{1 \text{ in}} \times \frac{1 \text{ m}}{100 \text{ cm}} \times \frac{1 \text{ km}}{1000 \text{ m}} =$$

def def def def def

$$3.75 \times 5280 \times 12 \times 2.54 \div 100 \div 1000 = 6.03504 \text{ km}$$

$$= \boxed{6.04 \text{ km}}$$

ex Convert 0.632 gal/hr into mL/min



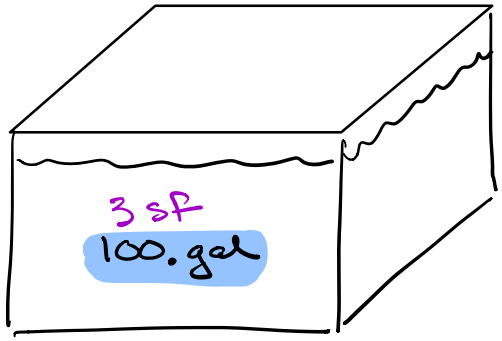
3 // 3 keys 4 def def

$$\frac{0.632 \text{ gal}}{1 \text{ hr}} \times \frac{3.785 \text{ L}}{1 \text{ gal}} \times \frac{1000 \text{ mL}}{1 \text{ L}} \times \frac{1 \text{ hr}}{60 \text{ min}}$$

$$= 39.868666 \frac{\text{mL}}{\text{min}}$$

$0.632 \times 3.785 \times 1000 \div 60$

$$= \boxed{39.9 \text{ mL/min}}$$



100 gal ⇒ 1 sf

100. gal ⇒ 3 sf

1.0×10^2 gal ⇒ 2 sf

Salt water

$d_{salt\ H_2O} = 1.23\ g/mL$

How many lbs is the aquarium going to weigh, excluding glass?

gal —(3 keys)→ L —(SI)→ mL —(density)→ g —(3 keys)→ lbs

Eng: gal (vol) | lbs (mass)

mL (vol) | g (mass)

$1\ mL = 1.23\ g$

Density: vol ⇄ mass

* 3 keys

$1\ in = 2.54\ cm$

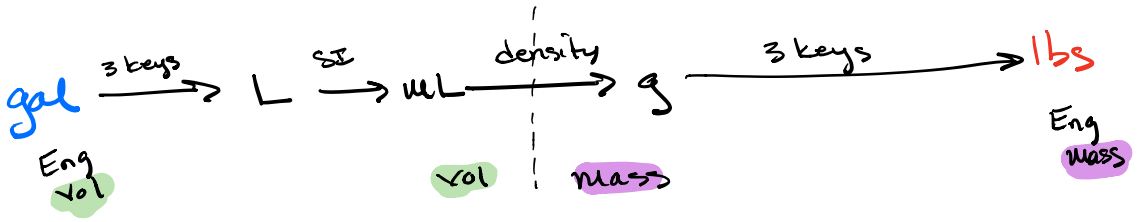
* $1\ gal = 3.785\ L$

* $1\ lb = 453.6\ g$

* find the bridge

* what conversion factor (equality) allows you to cross it?

* fill in left and right sides



1 mL = 1.23 g

* 1 gal = 3.785 L

* 1 lb = 453.6 g

numerator!

$$100.\ \text{gal} \times \frac{3.785\ \text{L}}{1\ \text{gal}} \times \frac{1000\ \text{mL}}{1\ \text{L}} \times \frac{1.23\ \text{g}}{1\ \text{mL}} \times \frac{1\ \text{lbs}}{453.6\ \text{g}} = \text{lbs}$$

(3 sig; 4; def; 3 sig; 4)

$$100 \times 3.785 \times 1000 \times 1.23 \div 453.6 = 1026.35582\ \text{lbs}$$

$$\frac{100.0\ \text{lbs}}{45{,}360.\ \text{g}} = \frac{1\ \text{lbs}}{453.6\ \text{g}}$$

(4; 4; placeholder for unit; 4 sig)

1026.35582

1030 lbs

or

1.03×10^{3} lbs

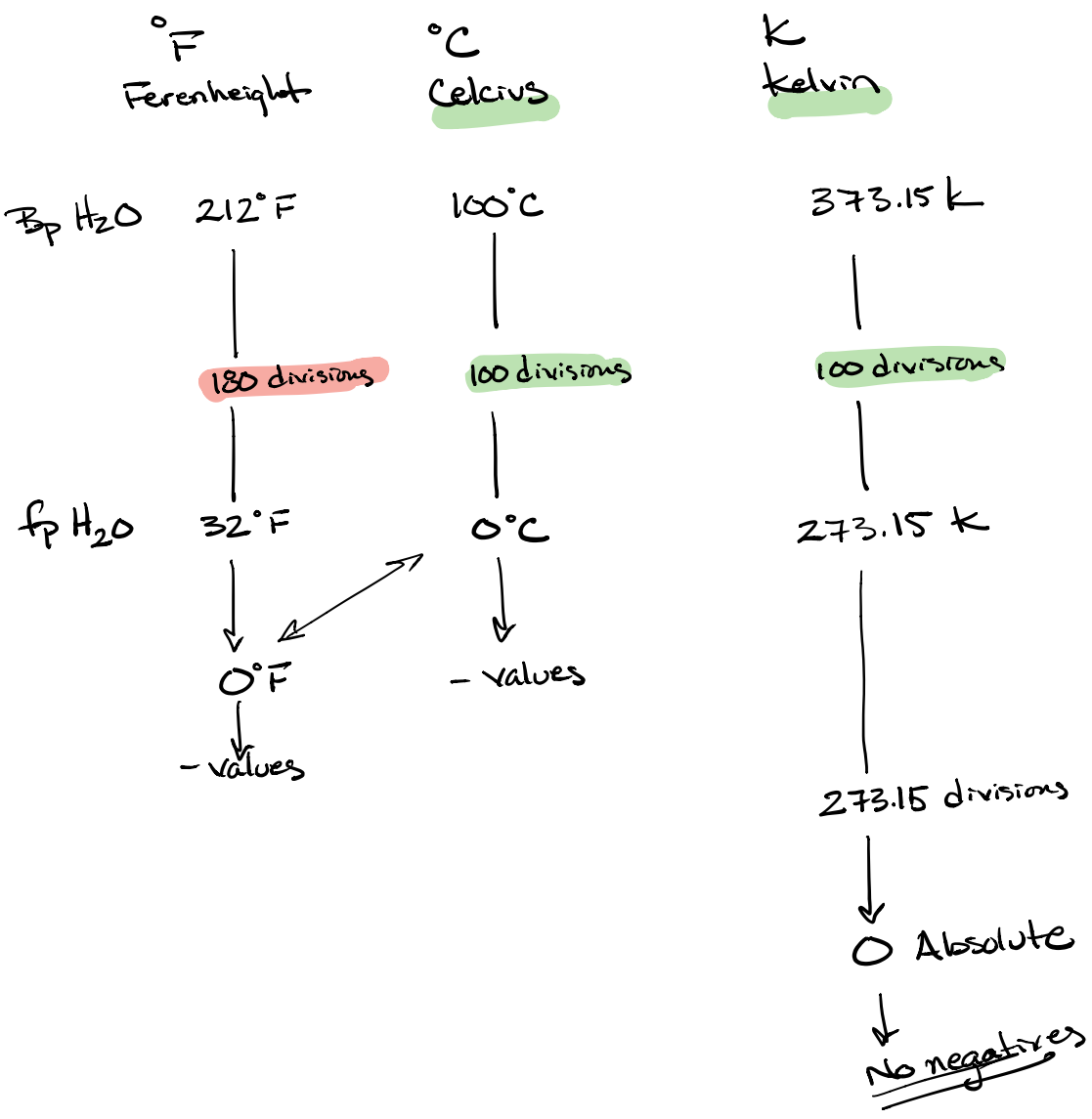
1304.6327 lbs round to 3 sig figs

1300 lbs $\Rightarrow$ 2 sf

1300. lbs $\Rightarrow$ 4 sf

1.30×10^3 lbs $\Rightarrow$ 3 sf

Temperature Conversions



Easy ⟹ just phase shift

K → °C °C → K

K − 273.15 = °C °C + 273.15 → K

°C → °F

$$°C \times \frac{180\,°F}{100\,°C} + 32\,°F = °F$$

Unit conversion Phase shift

$$(°C \times \tfrac{9}{5}) + 32 = °F$$

°F → °C

$$(°F - 32\,°F) \times \frac{100\,°C}{180\,°F} = °C$$

$$(°F - 32) \times \frac{5}{9} = °C$$

Correct usage

$$(103\,°F - 32\,°F) \times \frac{5}{9} = 39.4\,°C$$

3 sf 3 sf

Error ✗ $103\,°F - 32 \times \frac{5}{9} = 85.2\,°C$ ✗

°F → K

°F → °C $\xrightarrow{+273.15}$ K

K → °F

K $\xrightarrow{-273.15}$ °C → °F

Ex Convert 23.6°C into K and °F

$$\begin{array}{r} 23.6\ ^\circ C \\ +\ 273.15 \\ \hline 296.75 \end{array} = \boxed{296.8\ K}$$

(23.6 °C: 3 sf; 273.15: exact; 296.75 → 296.8 K)

$$23.6\ ^\circ C \times \frac{180}{100} + 32 = 74.48\ ^\circ F$$

(180: exact; 100: exact counted; 74.48: 3 sf)

$$= \boxed{74.5\ ^\circ F}$$

Chapter 2.1 Early atomic Theory

Dalton 1807

1) Atoms ⇒ smallest unit that could participate in Chemical Rxn.

2) Elements were a single type of Atom.
   ⇒ Atoms of different elements are different

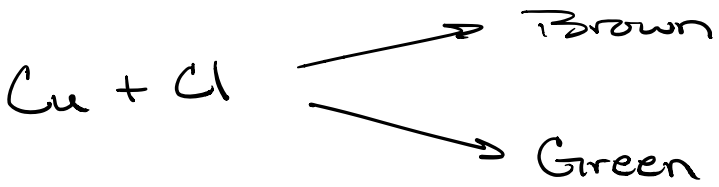
3) Atoms of an element all have the same properties

* 4) Compounds are made of 2 or more elements in whole # Ratios.
   ⇒ Atoms are Counted ⇒ Exact
   ⇒ Compound ratio fixed, always the same for that Compound
   H_2O 2 H's to 1 oxygen

5) Conservation of matter that atoms cannot be destroyed or created in Chemical Rxn.

Law of Multiple proportions

When two elements react to form more than 1 compound, a fixed mass of one element will react with the other element in a ratio of small whole numbers.



$CuCl_2$

1 g Cu + 1.116 g Cl → Brown Solid

1 g Cu + 0.558 g Cl → Green Solid

$CuCl$

$$\frac{\frac{1.116\ g\ Cl}{1\ g\ Cu}}{\frac{0.558\ g\ Cl}{1\ g\ Cu}} = \frac{2}{1}\ \text{ratio}$$

Cu^{+} | Cl^{-}

+1 −1

$CuCl$

Cu^{2+} | Cl^{-}, Cl^{-}

2+ 2−

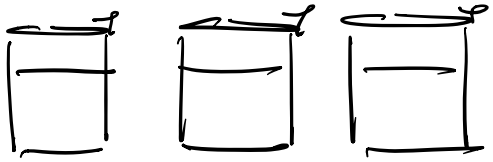
$CuCl_2$

Homogenous Mixture

uniform

Pure Substance

uniform



H_2O	100mL	100mL	100mL
NaCl	0.5g	1.0g	1.5g

All Homogeneous

But ⇒ Varying Ratios

$NaCl_1$

1:1 & Always the same

Ratio fixed