Flipping Physics Lecture Notes: Introduction to Conversions in Physics

Dimensions are your Friends: Please remember that the more you play with dimensions the more that they will be your friend and the more that they will help you out when you need them most; on a quiz or final exam.

No Naked Numbers: Always clothe your number answers with dimensions or units. Always. Okay, not really, however, it is a good place to start. Until we get to the coefficient of friction, μ, there will be no naked numbers.

Please don't do magic, it is not math. Just moving a decimal over is magic. You must do conversions.

$$1000mm = 1m \Rightarrow \frac{1000mm}{1000mm} = \frac{1m}{1000mm} \Rightarrow 1 = \frac{1m}{1000mm}$$

(1000 mm = 1 m is an exact conversion and has as many significant digits as you need it to have)

We can multiply any number by one and not change the original number, therefore we can multiply any number by the conversion factor $\frac{1m}{1000mm}$ because it is the same thing as multiplying by 1.

Example: Convert 11 millimeters to meters.

$11\cancel{mm} \times \frac{1m}{1000\cancel{mm}} = 0.011m$ is the same thing as $\frac{11\cancel{mm}}{} \Big| \frac{1m}{1000\cancel{mm}} = \boxed{0.011m}$

Example: Convert 4.2 centimeters to meters. 100 cm = 1 m

$$4.2\cancel{cm} \times \frac{1m}{100\cancel{cm}} = \boxed{0.042m}$$

Example: Covert 17 g to kg. 1 kg = 1000 g

$$17\cancel{g} \times \frac{1kg}{1000\cancel{g}} = \boxed{0.017kg}$$

Please do not write fractions like this: 17 g x 1 kg / 1000 g because it makes it very hard to know what dimensions to cancel.

Example: Convert $14\frac{m}{s}$ to $\frac{km}{hr}$ $\qquad 1hr \times \frac{60\min}{1hr} \times \frac{60\sec}{1\min} = 3600\sec$

It is useful to have memorized that 1 hour = 3600 seconds, it will come up often in physics.

$$14\frac{\cancel{m}}{\cancel{s}} \times \frac{1km}{1000\cancel{m}} \times \frac{3600\cancel{s}}{1hr} = 50.4\frac{km}{hr} \approx \boxed{5.0 \times 10^1 \frac{km}{hr}}$$

The answer needs to have 2 significant digits because the known value of 14 m/s had 2 sig figs.

Example: Convert 12.2 mm^2 to m^2. $\qquad 1m^2 \neq 1000mm^2$, $1m = 1000mm$

$$12.2mm^2\left(\frac{1m}{1000mm}\right)^2 = 12.2\cancel{mm^2}\left(\frac{1^2 m^2}{1000^2 \cancel{mm^2}}\right) = 12.2\cancel{mm^2}\left(\frac{1m}{1000\cancel{mm}}\right)\left(\frac{1m}{1000\cancel{mm}}\right)$$

$$\Rightarrow 12.2mm^2 = \boxed{0.0000122m^2 = 1.22 \times 10^{-5} m^2}$$

Example: Convert $120\frac{km}{hr^2}$ to $\frac{m}{s^2}$

$$120\frac{\cancel{km}}{\cancel{hr^2}}\left(\frac{1000m}{1\cancel{km}}\right)\left(\frac{1\cancel{hr}}{3600s}\right)\left(\frac{1\cancel{hr}}{3600s}\right) = 0.00925925\frac{m}{s^2} \approx \boxed{0.0093\frac{m}{s^2} = 9.3 \times 10^{-3}\frac{m}{s^2}}$$