Physics 11 : Course Notes

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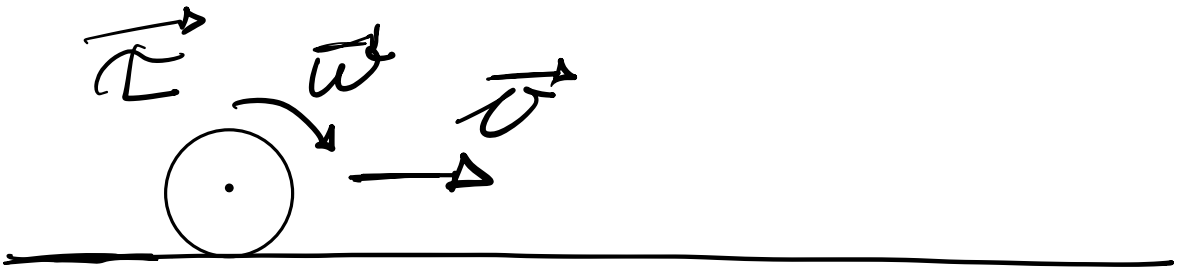
1 Introduction

This course will provide students with a very brief introduction to Newtonian mechanics, a branch of physics which explains the motion of moving bodies. Throughout this course students will encounter concepts such as Newtons laws, Energy conservation, Nuclear physics, Sounds and waves as well as Electromagnetic induction. Students are expected to have a developed background in mathematics as math is the concepts, ideas and relations in physics are described mathematically. Hence, students should be given an language of physics, all appropriate math pre-assessment testing basic concepts from algebra and trigonometry.



1000 m = 1 km 1 m = 3.28 ft
1000 g = 1 kg 3600 s = 1 hr

2 Units

Unlike mathematics, almost all quantities in physics are expressed in some units in a manner to which which allows us to make comparisons and understand the magnitude of a given quantity. For example in mathematics if I tell you that object $A = 50$ and $B = 20$, then you may immediately conclude that $A > B$, however in physics you may be skeptical about $A > B$ because what if $A = 50$g and $B = 20$kg. While solving problems throughout this course, you may encounter situations which require you to convert a quantity in a particular unit to another. For example, we almost always work in kg units in this course and therefore you may need to preform some sort of conversion operation to obtain a final quantity in kg. We will discuss below the general technique for approaching such problems, remember to always refer to the **Conversion Table** whenever solving such problems.

Example 2.0.1
I have a box weighing at 1250g. How much does this box weight in kg?

Solution
We proceed by cancelling units,

$$1250\,\text{g} \cdot \left(\frac{1\,\text{kg}}{1000\,\text{g}}\right) = \left(\frac{1250}{1000}\right)\,\text{kg} = 1.250\,\text{kg}$$

$\frac{g}{g} = 1$

Example 2.0.2
My vehicle is currently driving at a speed of speed $= 60\frac{\text{km}}{\text{h}}$, what is my speed in $\frac{\text{m}}{\text{s}}$?

Solution
We proceed by cancelling units,

$$60\frac{\text{km}}{\text{h}} \cdot \left(\frac{1000\,\text{m}}{1\,\text{km}}\right) \cdot \left(\frac{1\,\text{h}}{3600\,\text{s}}\right) = 16.667\frac{\text{m}}{\text{s}}$$

$\frac{1h}{3600s}$ or $\frac{3600s}{1h}$

(a) ~~Hi~~

(b) ~~hello~~

$$\frac{60 \cdot 1000 \cdot 1}{1 \cdot 3600} = 16.67$$

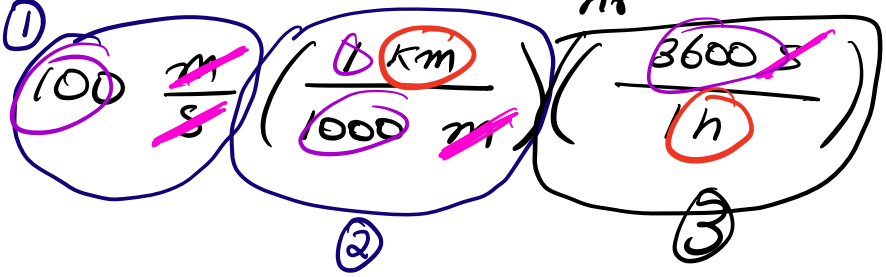
Explanation

g → kg

- setup a product of fractions such that all units cancel except for desired unit
- fractions → unit conversions
- 1000 m = 1 km

$\left(\frac{1\,\text{km}}{1000\,\text{m}}\right) = 1$ ← conversion factor → $\frac{1000\,\text{m}}{1\,\text{km}} = 1$

Ex. $100\ \frac{m}{s} \rightarrow \frac{km}{hr}$



$$100\ \frac{m}{s}\left(\frac{1\ km}{1000\ m}\right)\left(\frac{3600\ s}{1\ h}\right) = 360\ km/hr$$

does this

$m \rightarrow km$? $\Rightarrow \left(\frac{1\ km}{1000\ m}\right)$

$s \rightarrow h$? $\Rightarrow \left(\frac{3600\ s}{1\ h}\right)$

$$\frac{100 \cdot 1 \cdot 3600}{1000 \cdot 1} = 360\ km/hr$$

Ex 2 $361\ \frac{ft}{s} \rightarrow \frac{m}{hr}$

$1\ m = 3.28\ ft$

$3600\ s = 1\ hr$

$$361\ \frac{ft}{s}\left(\frac{1\ m}{3.28\ ft}\right)\left(\frac{3600\ s}{1\ hr}\right) = 396219.5\ \frac{m}{hr}$$

$$\frac{361 \cdot 3600}{3.28}$$