

# Physics 303K Honors Handout 1

1. SI standards are somewhat arbitrary, but they are nonetheless useful because they are invariable and accessible. We are familiar with SI units and English units. The fundamental SI units are: second, meter, kilogram, mole, Kelvin, Ampere, and candela. We also talked about natural standards defined by  $c$  (speed of light),  $G$  (gravitational constant), and  $h$  (Planck action). You can refer to <http://www.naturaltheology.net/Glossary/planckScale.html>
2. Dimensional analysis is powerful because you can check the consistency of your units and predict *a priori* the relations between some physical quantities and others. Recall the examples of  $F = ma$  and  $F = mv^2/r$ :

The only viable combination of force  $F$ , mass  $m$ , velocity  $v$ , and radius  $r$  with regards to units is:

$$F \propto \frac{mv^2}{r} \quad (1)$$

with

$$[F] = \frac{kg * m}{s^2}, [m] = kg, [v] = \frac{m}{s}, [r] = m \quad (2)$$

Note that  $\propto$  means 'is proportional to' and a variable with square brackets around it refers to its units (e.g.  $[m] = kg$  means 'the units of mass is the kilogram'). Try dimensional analysis when you need some direction on a homework or exam problem (especially when the question is multiple-choice, since often the units of wrong answers aren't consistent with the desired quantity!)

3. Remember, a meaningful figure will have three components: a number, units, and an uncertainty. We will not deal rigorously with uncertainty in 303K. The lab course 103M will teach you the techniques to calculate significant digits and precision. The homework service counts an answer correct if it is within 1% of the exact answer.

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