Tools for Success - Astro 105

No matter what you do in labs, it's important to **show your work, read the instructions, label all your numbers with appropriate units, and check to make sure your answer makes sense!**

1 Metric System

Scientists like using the metric system because scientists are lazy, and the metric system is super easy to use since it describes units in powers of 10. i.e. a meter is the base unit of length, but a centimeter is 100 times smaller than a meter, and a kilometer is 1000 times bigger than a meter. You can tell whether a certain unit is bigger or smaller than the base unit via its prefix - kilo, centi, etc. So easy!

Table 1.1: Metric System Prefixes

Prefix Name	Prefix Symbol	Prefix Value
Giga	G	1,000,000,000 (one billion)
Mega	M	1,000,000 (one million)
kilo	k	1,000 (one thousand)
centi	c	0.01 (one hundreth)
milli	m	0.001 (one thousandth)
micro	μ	0.0000001 (one millionth)
nano	n	0.0000000001 (one billionth)

2 Unit Conversion

So if you want to convert units, the first thing you need is a **conversion factor**. Here's the steps to making a conversion factor:

1. Find the equivalence statement that connects your unit you want to change to the unit you want it to be (i.e. 1 AU = 149,600,000 km).
2. Depending on what unit you want to end up with, divide both sides of the equation you just wrote down by the old unit. That way, your conversion factor will look like: $\frac{New\ unit}{Old\ unit} = 1$ (since the old unit will cancel out on one side of the equation)
3. Since your conversion factor is now equal to 1, you can multiply any number by it consequence-free! The laws of mathematics say it's okay to multiply anything by 1 because that doesn't actually change the number. Go ahead and multiply your number by the conversion factor to change it to the new unit.

Here's a quick example: Convert 34,000 km to AU.

$$1\ AU = 149,600,00\ km \rightarrow \frac{1\ AU}{149,600,000\ km} = \frac{149,600,000\ km}{149,600,000\ km} = 1$$

$$34,000\ km * \frac{1\ AU}{149,600,000\ km} = 0.000227 AU$$

A quick note: Make sure all of the same kind of units (i.e. length, time, speed, etc) all have the same units. As in, don't have kilometers and meters in the same calculation, because your answer will be off by a factor of 1000! Make sure both lengths are either in km or m.

3 Math stuff

I feel like the lab gives a good summary of exponents, scientific notation, and the like. I'll just summarize order of operations stuff here.
I use the acronym PEMDAS and the phrase Please Excuse My Dear Aunt Suzy to remember order of operations. The letters stand for:
Parantheses. Do any math that's in parantheses first. Apply PEMDAS to whatever you have to do inside the parantheses!
Exponents.
Multiplication and **D**ivision. These two go hand in hand; do multiplication or division operations as you come across them, reading the equation from left to right.
Addition and **S**ubtraction. Just like multiplication and division, do any adding or subtracting as you read the equation.

4 Plots

Basically, all you have to do when making plots is label everything: the x- and y-axis, your key, the graph itself.

Let me know if there's anything else you'd like more info on, and I'll update this document. Everything you need to know is in the Tools for Success lab, these are just my personal take on what you need to know.
And remember to feel free to send me an email/come in to office hours in case you need any help or have any questions!