

Dimensional Analysis or “How do we do math in APES?”

Objectives: Students will be able to setup & solve a dimensional analysis equation to determine how changing parameters can affect a system.

The following are components necessary to achieve the objective.

- * to determine which variables (units) to study/investigate.
- * to determine the parameters (units) that affect the system.
- * to successfully use scientific notation where applicable to solve dimensional analysis equations.
- * to successfully be able to use the results of dimensional analysis problems to explore further study of a system.

This year in APES you will hear the two words most dreaded by high school students...**NO CALCULATORS!** That’s right, you cannot use a calculator on the AP Environmental Science exam. Since the regular tests you will take are meant to help prepare you for the APES exam, you will not be able to use calculators on regular tests all year either. The good news is that most calculations on the tests and exams are written to be fairly easy calculations and to come out in whole numbers or to only a few decimal places. The challenge is in setting up the problems correctly and knowing enough basic math to solve the problems. With practice, you will be a math expert by the time the exam rolls around. So bid your calculator a fond farewell, tuck it away so you won’t be tempted, and start sharpening your math skills!

You may think *Dimensional Analysis* is not for everyone. But it's probably for you. First of all then, who should avoid *Dimensional Analysis* (DA)?

Reasons for not using Dimensional Analysis

- 1. Let's say you're super-intelligent and enjoy solving relatively simple problems in the most complex manner. (Just for fun.)*
- 2. Let's say you're tired of always getting the correct answers.*
- 3. Let's say you're an arty type and you can't be confined by the structure of DA. You like messy solutions scribbled all over the page in every which direction. It's not that you want to make a mistake. But you really don't care that much about the answer. You just like the abstract design created by the freewheeling solution... and, of course, the freedom from being confined by structure.*

Dimensional Analysis Plan

1. Breathe. Take a deep breathe.
2. Write down the conversion factors you know for each of the units as fractions.
3. Determine the given in the problem statement. It is often a fraction.
4. Identify what the question is asking for including units. Units are as important as any number.
5. Set up the question as an equation with what you know on the left side and what you want to find out on the right of the equal sign. Make sure you are using units.
6. Use the conversion factor fractions in the equation so the units cancel like variables.
7. Now use scientific notation and reduction to make the math easier. Rewrite the numbers after canceling to avoid mistakes in a long problem.