Unit 1

Math in Physical Science

Numbers

Generally, in this class, you should give your final answers in decimal form. If it is a fraction that makes sense, like $\frac{4}{5}$, fine, give it as a fraction. If it ends up being some weird fraction like $\frac{85}{217}$, please just use decimal form.

Rounding Decimals

Rounding Decimals

Answers should be rounded to two or three decimal places.

Scientific Notation

Why

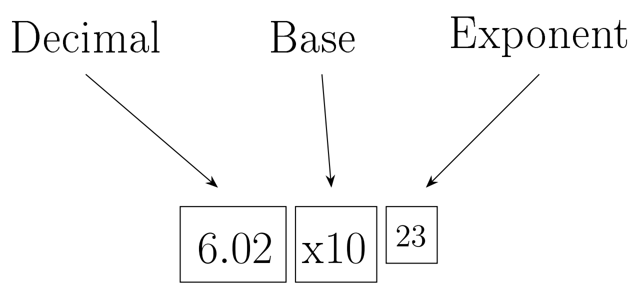
Scientific Notation is just a more convienent way to display really big and really small numbers. For instance, instead of writing

$$6{,}020{,}000{,}000{,}000{,}000{,}000{,}000{,}000$$

over and over in a problem, it is much more convienent to write

$$6.02 \times 10^{23}$$

How to read and write Scientific Notation



The Decimal portion of the number is just all of the numbers expressed so you have

One digit **.** (All the other numbers)

Examples: 1.157 2.23 1.050433404

The Base portion of the number is either 10^{25} or E25 to save space. Either is fine by me. The exponent tells you how far you have to move the decimal place to get back to the "normal" way of writing numbers...

If you have a positive exponent, it means you move the decimal to the right. If you have a negative exponent, it means you move the decimal to the left.

Calculators with one line displays often show exponents as E25 instead of $x10^{25}$

Negative exponents $\rightarrow$ numbers $<$ 1.
Positive exponents $\rightarrow$ big numbers at least $>$ 1

Units

Units of measurement give standards so that the numbers from our measurements refer to the same thing. [**units_of_measurement**]

Pretend someone tells you that they have a new cousin. You ask how old they are. They say 5. You might automatically assume that they mean 5 years old. What if they just got a new baby cousin, who is 5 months old?

Telling someone HOW something was measured is pretty important. We call the way we measured something a Unit.

Definition

Unit - What is used to tell HOW something is measured. This comes after the number. Examples: 15 **seconds** or

Solving Math Problems in Physical Science

Now that we have discussed what units are in Math and Science, let's look the general steps you should be doing for all of the math problems in this class. We will use an example problem from near the beginning of the year involving Gas Laws.

General Steps

When solving math-based problems in this class, you will generally follow the following five steps:

1. Write down the numbers that you are **GIVEN** (with units).
2. Write down the number you are asked to **FIND** (with units.)
   (a) I usually write a ? instead of a number, because we are going to solve for this. We don't know what it is yet!
3. Narrow down your formulas until you have one that allows you to solve for the missing number.
   (a) Look at your list of **GIVENS** and **FINDS** and pick a formula that has the same variables in it as are in the list
      i. For instance, if you are given Pressures and Volumes, and are asked to find a Volume, you should look for a formula involving Pressures and Volumes
         A. This would be Boyle's Law
4. Get the correct version of the formula you chose, so that it reads

   FIND = ...all the other variables you are given

   (a) You can do this with algebra (if you have learned that in your math class) OR
   (b) Pick the correct "version" of the formula from the list provided by Mr. Vober. Check the wall or your notes for the different "versions".
5. Plug in the **GIVENS** into the matching places in the formula you chose.
6. Solve the math problem
7. Record you final answer, **with units**.
   (a) The units for the answer will be the same as the same type of number in the **GIVENS**
   (b) Example: You are solving for a mass, and the **GIVEN** mass is measured in $kg \rightarrow$ your answer will also be in kg

Worked Example 1

Example 1

A balloon is filled with air. The pressure of the balloon is 10 atm to start. This expands it to a starting volume of 2 mL. The balloon is then squeezed to a new pressure of 28 atm. What would be the new volume of the balloon after it is squeezed?

Find

$V_2 = ?$

"What would be the new volume of the balloon after it is squeezed?" is asking us to find V_2

Given

$P_1 = 10\,\text{atm}$ $\quad V_1 = 2\,\text{mL}$ $\quad P_2 = 28\,\text{atm}$

The problem tells a story. I can tell if the variable is P, V or T from the units. The $_1$ and $_2$ are from reading the story. If the value is from *before* we changed something, then it is a $_1$, otherwise, it is from *after* we changed something, and it gets a $_2$

Formula

$$\underbrace{V_2}_{\text{The "Find" variable}} = \underbrace{\tfrac{P_1 \cdot V_1}{P_2}}_{\text{Your "Given" a.k.a. "Known" variables are on this side.}}$$

Work

$$V_2 = \frac{P_1 \cdot V_1}{P_2}$$

$$V_2 = \frac{(10\,\cancel{atm}) \cdot (2\,\text{mL})}{(28\,\cancel{atm})}$$

$$V_2 = \frac{(20\,\text{mL})}{(28\,)}$$

You can treat the units and numbers almost as two seperate things. See 1.2 for more details.

Answer with units

$$\boxed{V_2 = 0.71\,\mathrm{mL}}$$

0.71428571428 rounded to two decimal places.