A Guide to Dimensional Analysis

1. Determine what you **want** to know. Read the problem and identify what you're being asked to figure out, e.g. "how many milligrams are in a liter of solution."
   a. **Rephrase** if necessary using "per." Example: You want to know "milligrams per liter."
   b. **Translate** into "math terms" using appropriate abbreviations to end up with "mg/L" as your answer unit (AU). Write this down, e.g. "AU= mg/L"
2. Determine what you already **know**.
   a. What are you **given** by the problem, if anything? Example: "In one minute, you counted 45 drops."
      - **Rephrase** if necessary. Think: "Drip rate is 45 drops **per** minute."
      - **Translate** into math terms using abbreviations, e.g. "45 gtt/min"
         - If a given is in the form mg/kg/day, rewrite as mg/kg x day (see example 4)
         - If a percentage is given, e.g. 25%, rewrite as 25/100 with appropriate labels (see example 5)
   b. Determine **conversion factors** that may be needed and write them in a form you can use, such as "60 min/1 hour." You will need enough to form a "bridge" to your answer unit(s). See example 1.
      - Factors known from memory: You may know that 1 kg = 2.2 lb, so write down "1 kg/2.2 lb" and/or "2.2 lb/1 kg" as conversion factors you may need.
      - Factors from a conversion table: If the table says "to convert from lb to kg multiply by 2.2," then write down "2.2 lb/1 kg"
3. **Setup** the problem using only what you need to know.
   a. Pick a **starting factor**.
      - If possible, pick from what you know a factor having one of the units that's also in your answer unit and that's in the right place. See example 1.
      - Or pick a factor that is given, such as what the physician ordered.
      - Note that the starting factor will always have at least one unit not in the desired answer unit(s) that will need to be changed by canceling it out.
   b. Pick from what you know a conversion factor that cancels out a unit in the starting factor that you don't want. See example 1.
   c. Keep picking from what you know factors that cancel out units you don't want until you end up with only the units (answer units) you do want.
   d. If you can't get to what you want, try picking a different starting factor, or checking for a needed conversion factor.
   e. If an intermediate result must be rounded to a whole number, such as drops/dose which can only be administered in whole drops, setup as a separate sub-problem, solve, then use the rounded off answer as a new starting factor. See example 9.
4. **Solve**: Make sure all the units other than the answer units cancel out, then do the math.
   a. Simplify the numbers by cancellation. If the same number is on the top and bottom, cancel them out.
   b. Multiply all the top numbers together, then divide into that number all the bottom numbers.
   c. Double check to make sure you didn't press a wrong calculator key by dividing the first top number by the first bottom number, alternating until finished, then comparing the answer to the first one. Miskeying is a significant source of error, so always double check.
   d. Round off the calculated answer.
      - Be realistic. If you round off 74.733333 to 74.73 mL that implies that all measurements were of an extreme accuracy and that the answer is known to fall between 74.725 and 74.735, or 74.73 $\pm$ 0.005 mL. A more realistic answer would probably be 74.7 mL or 75 mL. See example 6.
      - If you round to a whole number that implies a greater accuracy than is appropriate, write your answer to indicate a range, such as 75 $\pm$ 5 mL. See example 9.
   e. Add labels (the answer unit) to the appropriately rounded number to get your answer. Compare units in answer to answer units recorded from first step.
5. Take a few seconds and **ask yourself if the answer you came up with makes sense**. If it doesn't, start over.