

## Medication Math Tutorial for Associate Degree Nursing Students ~2nd level Teaching Points~

We care about getting a math problem 100% correct and don't give partial credit for "I set up the problem right, but just made a simple mistake with the calculator" etc., *because in the real world a potentially life-threatening medication error still happens to the patient regardless of how "close" to being correct you were in the process of figuring it out.* It's that important.

### 1. NECESSARY BACKGROUND MATH KNOWLEDGE:

- Moving from the **apothecaries** and **household** measurement systems to the **metric system**. We give all medications in metric system equivalents (mg, ml) even though some of the data you need is given in another system. You need to know the conversions to move between these systems. (lb to kg, grains to mg, tsp to ml, etc).
- Understanding the metric system:
  - **units of weight/mass** (kg, grams, mg, mcg);
  - **units of length** (kilometer, meter, cm, mm);
  - **units of volume** (liter, ml).You can easily move up and down in value within each category by moving the decimal point to the right or left by tenths, but you cannot move between them.
- Thinking logically, and knowing how to set up a **ratio: proportion** to solve a problem. "If this is to this, *then* that would be to what?" You cross multiply and divide to solve.

### 2. TIPS FOR SETTING UP MED MATH PROBLEMS:

- Once you are handed the test **write down everything you KNOW at the top of the paper**. (D/H x Q = amount of drug to administer; V/T x drop factor = Rate; 1 kg = 2.2 lb; 1 grain = 60mg; 1mg = 1000mcg, etc.) That way once you start to read questions and your anxiety starts creeping in and everything you KNOW starts to run screaming out of your head, you've already got it written down to refer to. 😊
- **Identify the components of the question:**
  - "This looks like a doctor's ordered dose." (grams, mg, mcg, units, mEq, grains, or mg/kg/day, for example)
  - "This looks like a volume." (ml)
  - "This looks like the dose on hand." (grams, mg, mcg, units or mEq)
  - "This is the patient's weight." (kg or lbs)
  - "This looks like a rate." (ml/hr or drops/min)
  - "This is a drop factor." (drops/ml)
  - "This looks like a time." (minutes or hours)

That way you'll be able to figure out what is relevant information that you'll need to use to solve the problem and *what isn't*, once you've identified the type of problem you have.

- **Identify the question to be answered:**
  - "I need to find an IV flow rate."
  - "I need to find out what dose of drug to give."
  - "I need to find out how long it will take the IV to infuse."
  - "I need to figure out the patient's weight in pounds and ounces."
  - "I need to figure out the total daily dose (24 hour dose) ordered for the patient."

- “I need to figure out the patient’s weight in kg.”
- “I need to figure out the concentration (mg/ml) of the reconstituted vial of powdered drug.”
- “I need to figure out the ordered dose per kg of patient weight (mg/kg).”

This helps you figure out what type of calculations you will need to do, and when you’re done with the problem you can check to see if your answer matches the question asked.

- **Make any necessary conversions into the metric system from other systems of measurement first.** (lb to kg, grains to mg etc)
- **Then set up the math equation needed:**
  - **If Dosage equation: D (Doctor’s ordered dose or Desired dose) over H (dose on Hand) times Q (Quantity the dose on hand is supplied in).**

$$\frac{\text{D (Desired dose)}}{\text{H (dose on Hand)}} \times \text{Q(Quantity)} = \text{amt to give}$$

- **If Flow Rate equation:**
  - **If using an IV pump: V (Volume to be delivered) over T (Time it is to be delivered over) = R (Rate); answer will be in *ml/hr*.**  $\frac{\text{Vol}}{\text{Time}} = \text{Rate}$
  - **If not using an IV pump: Volume over Time times the drop factor of the tubing used (drops per ml) = Rate; answer will be in *drops/min*.**

$$\frac{\text{Vol}}{\text{Time}} \times \text{drop factor (drops/ml)} = \text{Rate}$$

- **If Ratio: Proportion equation.** Example: **if** there are 16 ounces in 1 pound, **then** how many ounces (x) is .6 of a pound?

$$\frac{16 \text{ oz}}{1 \text{ lb}} = \frac{x \text{ oz}}{.6 \text{ lb}}$$

Cross multiply and divide.  $x = 9.6$  ounces. Therefore .6 lb equals 9.6 ounces.

Depending on the complexity of the question there may be multiple steps, using different types of equations in each step, to arrive at a final answer.

- Note: There are many different methods to choose from in solving med math equations other than the *formula method* given here. Using the *ratio: proportion method* or the *constant method* also works well and may make more sense for some students. It’s an individual preference. Whatever works best for you is the method you should use and stick with.
- Make sure to **label the unit of measure for each number used** in the equation. There must be the same term (unit of measure) above and below the division line in a dosage equation (mg over mg, mcg over mcg, etc), or across from each other in a ratio: proportion equation (ounces is to lbs as ounces is to lbs).

### 3. SOLVE.

- **Use your calculator** even if you think you can do the math in your head.

- Make sure your answer is taken to the step that will directly answer the question asked, and is labeled correctly. (For example, if the question asks for a *rate* your answer will need to be in *ml/hr* if it says you are using an IV pump or in *drops/minute* if you're not.)
- Round appropriately (see guidelines).
- Circle your answer.

#### 4. GENERAL GUIDELINES:

- **Don't do any rounding of the numbers you get during the steps of your problem until the end of the problem.** Then an answer rounded to the nearest tenth (or hundredth in some instances) is generally sufficient.
- Once your answer is initially rounded to the nearest tenth or hundredth, if it is a dosage or flow rate question, apply it to the real life setting to see if the answer is stated as the nearest **deliverable** dose. If your calculated answer is 1.2 tablets, for example, ask yourself "am I really able to administer 1.2 tablets?" (or 1.9 suppositories, or 21.7 drops/min)? If not, **round again to the nearest deliverable dose.**
- Assume you can give half (.5) of a tablet as long as the question doesn't state that it's enteric coated, timed release, sublingual or a capsule. Assume you can administer liquid medications or injectables to the nearest tenth (.1).
- **Show all of your work** – this means all the steps of your calculations and both the calculator answer, as well as the final rounded answer. (ie... $x/y = "1.2 \text{ tablets or give } 1 \text{ tablet}"$ )
- **Follow the rules of math when rounding answers** on math test questions: if the number is .1-.4 round down, if .5-.9 round up. (Note: it is generally acceptable to round delivered dosages as long as it doesn't alter the doctor's ordered dose by more than 10%.)
- When finished with the entire test, go back and **recheck all your calculator computations for key pad errors only.**
- Do not second guess yourself. **Trust your knowledge.**
- Take a deep breath and **congratulate yourself** for all of your hard work and effort. You are awesome.

#### REVIEW OF QUICK STEPS:

1. Identify the components of the question and the question to be answered.
2. Make any conversions necessary.
3. Choose and set up the math equations needed and label all terms.
4. Do the computations with a calculator.
5. Round your answer appropriately.
6. Double check to make sure you answered the question asked, and circle your answer.