Compounding

Introduction

Pharmacists and pharmacy technicians all compound medications in one way or another. The most common compounding you are likely to do is the preparation of intravenous (IV) solutions. This compounding is fairly straightforward and will involve primarily proportional calculations.

Proportional Calculations

You will use proportional calculations often in the pharmacy, especially in the IV room. Proportional calculations involve using an available drug concentration and a desired final drug amount (in either weight or volume) to determine the amount of each individual ingredient to add.

Steps

1. Write your final units (the units you would like to arrive at) on the right-hand side of the page first. Leave a small space to the left, and then write an = sign.

2. On the left-hand side of the page, begin to line up all of your available data. Be sure to include a unit for every number. If you’re dealing with more than 1 drug or drug strength, assign a drug name to all necessary units.

3. Flip-flop proportions as needed so that the units cancel out. Make sure that all possible units cross out. If you have done it correctly, you will end up with the same units in the numerator (and denominator, if appropriate) of the final units on the right-hand side of the equation. If you have additional units left that have not cancelled out, then you have missed an important dimension or included an unnecessary one.

4. Perform your calculations.
Proportional Calculation Example

You need to mix syringes filled with 1 gm cefazolin in 20 ml diluent. Your stock solution contains 200 mg cefazolin/ml. You need to know how many milliliters of the stock solution you will need to draw up and place in an empty, sterile 20 ml syringe. Then, you will add diluent to the syringe to fill it up the rest of the way to 20 ml. Each step of the dimensional analysis is noted.

Step 1: Write out your final units first.

_____________ = ml cefazolin stock solution to add to each syringe

Step 2: Line up your available data.

1000 mg 1 ml = ________________ml cefazolin stock solution to add to each syringe
200 mg

Step 3: Flip-flop proportions where necessary to ensure that units cancel out.

1000 mg 1 ml = ________________ml cefazolin stock solution to add to each syringe
200 mg

Step 4: Perform your calculations.

1000 mg x 1 ml = 5 ml cefazolin stock solution to add to each syringe
200 mg

You will then add an additional 15 ml of D5W or NS, or the diluent used for your standard concentration, to make a total of 20 ml in each syringe.

Dilution / Concentrations

As a pharmacy technician, you will occasionally encounter a situation where you need to calculate the strength of a given solution. When a solvent from a liquid medication is evaporated, its concentration is increased. Also, when a liquid medication of a given strength is diluted, its strength will be reduced. For example, 10 mL of a solution containing 1 gm of a substance has a strength of 1:10 or 10% w/v. If this solution is diluted to 20 mL, e.g., the volume of the solution is doubled by adding 10 mL of solvent, the original strength will be reduced by one half.
to 1:20 or 5% w/v.

To calculate the strength of a solution prepared by diluting a solution of known quantity and strength, an equation may be set up as follows:

Where,

\[ C_1 = \text{Initial concentration} \]
\[ V_1 = \text{Initial volume} \]
\[ C_2 = \text{Final concentration after dilution} \]
\[ V_2 = \text{Final volume after dilution} \]

From this expression, strength (or final concentration of the solution) can be determined.

Calculating the volume of a solution's desired strength can be accomplished by diluting a known quantity of a solution.

**Dilution Example**

If 5 mL of a 10% w/v aqueous solution of genistein is diluted to 10 mL, what will be the final strength of genistein?

\[ 10(\%) \ (C_1) \times 5(\text{mL}) \ (V_1) = X(\%) \ (C_2) \times 10(\text{mL}) \ (V_2) \]

\[ X = 5 \times 10/10 \]

\[ X = 5\% \text{ w/v, answer} \]

**Alligation Medial**

Alligation medial is a technique to determine what the concentration of a solution is when 2 or more liquids of known concentration are mixed. For example, when 5 mL of 2% alcohol is mixed with 10 mL of 4% alcohol, we will know by the alligation medial method that we will obtain 15 mL of 3.33% alcohol. The resulting strength can be considered a “weighted average” of the percentage strengths of all the individual components used. Thus, the alligation medial is a method where the percentage strength of the mixture may be calculated by dividing the sum of the products of percentage strength of each constituent of the mixture multiplied by its corresponding quantity.
by the sum of the quantities mixed. This sounds complicated but is actually simple when broken down into steps.

What is the percentage of alcohol in the following mixture?

Alcohol 2% 5 mL
Alcohol 4% 10 mL

**Step 1:** Add the quantity of each component.

5 mL + 10 mL = 15 mL

**Step 2:** Multiply the quantity of each component used in the mixture by its corresponding percentage strength, and add up the products.

5 x 2% = 10
10 x 4% = 40
Total = 50

**Step 3:** Divide the value obtained in Step 2 by the value obtained in Step 1.

50 / 15 = 3.33%, answer

**Accurately Performing Compounding Calculations**

Because pharmacy technicians deal with medications that could harm, and, in some cases, even kill patients, if the dose is miscalculated, you must use a method that will allow you to calculate an accurate number every time.

**Question**

1. Why are proportional calculations used in pharmacies?
2. Why is it important to be able to calculate the strength of a solution?
3. What is alligation medial used for in the pharmacy?