Review calculation procedures for the following:

Convert in the Metric System

- 1000 mg = 1 gram
- 1000 mL = 1 liter
- To convert from grams to mg, move the decimal point 3 places to the right (add zeros to accommodate the decimal places).
  - 3.0 grams = 3000 mg
- To convert from mg to grams move the decimal point 3 places to the left.
  - 2500 mg = 2.5 mg

Ratio and Proportion

Ratio and proportion, such as 1.5 g of medication in a 100 mL piggyback of IV fluid = a concentration of medication in the IV fluid of 15:1.

- Convert g to mg to match the mL units.
  - 1.5 g = 1500 mg
- Calculate the amount of medication in each mL of fluid.
  - 1500 mg/100 mL
- Reduce the fraction to the lowest common denominator (divide the numerator and the denominator by 100).
  - 15/1 or a ratio of 15:1

It is important to keep the amount of medication as the numerator (top number) because the ratio is the ratio of medication to IV fluid.

Dosage in kg of Body Weight

Your patient weighs 150 pounds. He has an order for a medication dose of 20 mg/kg/day. What is his daily dose of medication?

- Calculate his weight in kg.
  - 150 lb = ? kg
  - 1 lb = 2.2 kg
  - 150/2.2 = 68.18 ≈ 68 kg
• Calculate the daily dose of medication; Multiply the daily dose by the number of kg.
  
  o 20 mg/kg/day X 68 kg = 1360 mg/day

Calculate the Volume of Medication plus IV Fluid

Your patient has an order for 500 mg of a medication IV piggyback. The medication is available 75 mg/10 mL. You will add the medication to 200 mL NS for administration. What is the total volume of medication plus IV fluid?

• Calculate the volume of medication required for the 500 mg dose.
  
  o Desired Dose = Available mg
    x mL = Available mL
  
  o 500 = 75 mg Cross multiply.
    x mL 10 mL
  
  o 75x = 5000 Divide each side by 75.
  
  o x = 66.6 ≈ 67 mL

• Calculate the volume of medication plus IV piggyback fluid.
  
  o 67 mL + 200 mL = 267 mL

Calculate the Volume for a Dose in Units

A medication is available 10,000 units/5 mL. To prepare a dose of 20,000 units, how many mL are needed?

• Calculate the volume of medication required for a dose of 10,000 units.
  
  o Desired Dose = Available mg
    x mL = Available mL
  
  o 20,000 units = 10,000 units Cross multiply.
    x mL 5 mL
  
  o 10,000x = 100,000 Divide each side by 10,000.
  
  o x = 10 mL

Calculate the Amount of Medication in a Single-dose Vial

A 5 mL single-use vial contains medication in a concentration of 10 mg/5 mL. How many mg of the medication does 3.5 mL contain?
- Calculate the amount of medication in 3.5 mL of solution.
  
  o **Desired Dose** = **Available mg**
    x mL       Available mL
  
  o \[
    \frac{x}{3.5 \text{ mL}} = 10 \text{ mg}
  \]
  
  o \[
    \frac{x}{3.5 \text{ mL}} = 10 \text{ mg} \quad \text{Cross multiply.}
  \]
  
  o \[
    350 = 5x \quad \text{Divide each side by 5.}
  \]
  
  o \[
    x = 70 \text{ mg}
  \]

**Calculate BSA from Pounds and Inches**

What is the BSA of a patient who weighs 165 pounds and is 5 feet 5 inches tall?

BSA \( (\text{m}^2) \) = \( \sqrt{\text{Height(in)} \times \text{Weight(lbs)}} \)

| \( \sqrt{65 \times 165} \) = \( \sqrt{10725} \) = \( \sqrt{3.4} \) = 1.85 |
|-----------------|---|---|
| 3131 | 3131 |

**Calculate the Volume for a Dose Ordered in mg/m\(^2\)**

Your patient, with a BSA of 1.6 m\(^2\), has an order for a medication 1.5 mg/m\(^2\) subcut. The medication is available in a concentration of 5 mg/mL. The ordered dose contains how many mL?

- Calculate the dose of medication required for a BSA of 1.6 m\(^2\).
  
  o \[
    1.6 \times 1.5 \text{ mg} = 2.4 \text{ mg}
  \]

- Calculate the mL that contains 2.4 mg.
  
  o **Desired Dose** = **Available mg**
    x mL       Available mL
  
  o \[
    \frac{2.4}{x \text{ mL}} = 5 \text{ mg} \quad \text{Cross multiply.}
  \]
  
  o \[
    5x = 2.4 \quad \text{Divide both sides by 5.}
  \]
  
  o \[
    x = 0.48 \text{ mL} \approx 0.5 \text{ mL}
  \]
Calculate the Recommended Dosage Range Based on BSA.
The recommended dosage range for a medication is 200 – 250 mg/m². Your patient’s BSA is 1.6 m². For this patient, what is the recommended dosage range?
- Calculate the mg dose for the minimum and maximum points of the range.
  - 1.6 X 200 = 320 mg
  - 1.6 X 250 = 400 mg
  - Recommended dosage range for this patient = 320 mg minimum – 400 mg maximum

Calculate the Number of Vials Needed to Prepare a Dose.
A patient is to receive a 360 mg dose of a medication. The medication is available in 60 mg vials and 100 mg vials. How many vials of each concentration are needed to prepare the ordered dose?
- 3 X 100 = 300 + (1 X 60) = 360
- Three 100 mg vials and one 60 mg vial
- Six 60 mg vials would also be correct, however it is more economical to use the 100 mg vials.

Calculate IV Infusion Rates.
Your patient, who weighs 165 lbs, is to receive a dose of immunoglobulin (IGIV) titrated starting at 0.5 mL/kg/hr X 30 minutes and increasing up to 4 mL kg/hr as tolerated. What is the beginning rate? What is the maximum rate?
- Calculate his weight in kg.
  - 165 lb = ? kg
  - 1 lb = 2.2 kg
  - 165/2.2 = 75 kg
- Start rate = 0.5 mL/kg/hr = 0.5 X 75 per hour = 37.5 ≈ 38 mL/hr
- Maximum rate = 4 mL/kg/hr = 4 X 75 per hour = 300 mL/hr
~Your patient is to receive 300 mg of a medication in 500 mL DsW to be infused over 90 minutes. The medication is available in a 20 mg/mL concentration. How many mL/hr should be infused? (Ignore bag overfill)

- Calculate how many mL the medication will add to the 500 mL.
  - Desired Dose = Available mg
    \[ \text{x mL} \quad \text{Available mL} \]
  - 300 mg = 20 mg Cross multiply.
    \[ \text{x mL} \quad 1 \text{ mL} \]
  - 20x = 300 Divide both sides by 20.
  - x = 15 mg
  - 500 mL IV fluid + 15 mL medication = 515 mL

- Calculate the correct rate to run over 90 minutes.
  - 90 minutes = 1.5 hours
  - 515 mL/1.5 hours = 343.3 mL/hr \approx 343 mL/hr

~Your patient is to receive IV infusion of 300 mg of a medication in 100 mL of normal saline at 125 mL/hr every 12 hours. How many minutes will it take to administer the 300 mg dose of medication?

- 125 mL/hr = 125 mL/60 minutes = 2.08 mL/min \approx 2 mL/min
- 100 mL/2 mL per minute = 50 minutes

~A patient is to receive a 250 mL bolus of normal saline infusion over 1 hour prior to the administration of a medication. The macrodrip set delivers 10 drops/mL of solution. The infusion runs at how many drops per minute?

- Calculate the drops/min rate: IV drip rate in drops per minute = Volume to be infused (mL) over 1 hour/ Drop factor constant

<table>
<thead>
<tr>
<th>Common drop factors</th>
<th>Drop factor constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 gtt/mL - minidrip set</td>
<td>1</td>
</tr>
<tr>
<td>10 gtt/mL – regular drip set</td>
<td>6</td>
</tr>
<tr>
<td>15 gtt/mL – regular drip set</td>
<td>4</td>
</tr>
</tbody>
</table>

Common drop factors are also known as the clock method – drop factors are obtained by
dividing 60 minutes by the number of gtts per mL that the IV set delivers.

- 10 gtts/min = drop factor of 6
- Divide the mL/hr by the drop factor.
- \( \frac{250 \text{ mL/hr}}{6} = 41.6 \text{ gtts/min} \approx 42 \text{ gtts/min} \)

~A patient is to receive a 300 mg dose of a medication in 75 mL D\(_5\)W over 45 minutes. The IV infusion set delivers 20 drops/mL. The infusion runs at how many drops per minute?

- 20 gtts/mL X 75 mL = 1500 gtts over 45 minutes
- 1500 gtts/45 minutes = 33.3 \( \approx 33 \) gtts/min

~A patient is to receive a dose of 150 mg of a medication in 100 mL D\(_5\)W to be infused over 30 minutes. The medication is available in a 200 mg/10 mL vial. How many total mL will be infused over 20 minutes?

- Calculate how many mL of medication is to be added.
  - Desired Dose = \( \frac{\text{Available mg}}{\text{Available mL}} \times \text{mL} \)
  - \( 150 \text{ mg} \times \frac{10 \text{ mL}}{200 \text{ mg}} = 7.5 \text{ mL of medication to be added to 100 mL D}_5\text{W} \)

- Calculate total volume of fluid = 100 + 7.5 mL = 107.5 mL \( \approx 108 \) mL.
- 20 minutes = 2/3 of the total time for 108 mL
  - 30 minutes
- 2/3 X 108 mL = 72 mL
~The infusion rate of an IV fluid is 10 drops/min, how much volume will be delivered in 8 hours if the drop factor is 12 drops/1mL?

- Calculate the number of drops/hr.
  - 10 gtt/min × 60 minutes = 600 drops/hr
- Calculate the number of mL/hr.
  - 600 drops/12 drops per mL = 50 mL/hr
- Calculate the number of mL/8hr.
  - 50 mL/hr × 8 hours = 400 mL

~A patient is to receive a dose of 120 mg of a medication in 100 mL normal saline. The medication is available in a vial containing 75 mg/37.5 mL. You will prepare how many mL?

- Calculate how many mL of medication are to be added.
  - Desired Dose = Available mg
    x mL = Available mL
  - 120 = 75 mg Cross multiply.
    x mL = 37.5 mL
  - 75x = 4500 Divide each side by 75.
  - 4500/75 = 60 mL of medication to be added to 100 mL D₅W

~75 mL of solution contains 200 mg of medication. How many mL of solution can be made if 1.5 g of the medication is available?

- Convert 1.5 g to mg = 1500 mg.
- Calculate how many mL can be made with 1500 mg of medication.
  - Desired Dose = Available mg
    x mL = Available mL
  - 1500 = 200 mg Cross multiply.
    x mL = 75 mL
  - 200x = 112500 Divide each side by 200.
  - 112500/200 = 562.5 mL of solution can be made from 1500 mg of medication
Another approach is to calculate the number of mg/mL.
  - \(200 \text{ mg}/75 \text{ mL} = 2.67 \text{ mg/mL}\)
  - \(1500 \text{ mg}/2.67 \text{ mg/mL} = 561.79 \text{ mL} \approx 562 \text{ mL}\)

**Review** *The ASHP Discussion Guide for Compounding Sterile Preparations (USP Chapter 797)*


Give particular attention to:

- Which areas are considered a primary engineering control (PEC)
- The order for donning PPE
- Frequency with which personnel who prepare IV medications should complete media-fill challenge testing
- When admixture personnel should complete a process validation of aseptic technique before compounding sterile products

**Review infection prevention and safety principles related to medication administration, including:**

- Correct handwashing procedure
- Parts of the syringe which must remain sterile during medication preparation
- Correct angle for entry of needle into a vial to prevent coring the stopper
- Rules for proper disposal of used waste
- Checks needed before compounding an IV admixture:
  - Correct medication
  - Concentration of medication
  - Correct volume of medication to be drawn up for injection into IV bag
  - Correct type and volume of IV bag
- Factors which affect stability of a medication, including light, humidity, opening the container
Review the procedure for reconstituting a medication from a lyophilized cake, including allowing the diluent to stream down the inside surface of the vial, thoroughly wetting the cake, and gently rolling the vial between your hands until the medication is dissolved.