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Section 1

Conversions

Pharmacological Calculations are reliant on specific systems of measure and the Technician’s ability to quickly and accurately convert between them. There is a simple equation that can be used to convert between any two types of units.

For example, let’s assume you’re tasked with converting 7.5mL to units. First, you’ll need to know how many units there are in 1mL (100u = 1mL).

Next you set up the first and last equation that you’ll need:
If I know there are 100u in 1mL how many units are in 7.5mL?

\[
\frac{100 \text{ units}}{1 \text{ mL}} = \frac{X \text{ units}}{7.5 \text{ mL}}
\]

To solve the conversion equation that you’ve set up,

**Cross-Multiply and Divide.**

\[
7.5 \text{ mL} \times 100 \text{ units} = 750
\]

\[
750 / 1 \text{ mL} = 750 \text{ units}
\]

By utilizing this simple way to set up conversions, you’ll have greater success in solving them. Once again, this equation can be adapted to solve most of the conversions you’ll be expected to know for the Pharmacy Technician Certification Exam® and while practicing in a Pharmacy.
Many students struggle mightily when trying to grasp the **Metric System**. Honestly, it is not as hard as you might think. In regard to Pharmacological Calculations, we are not concerned with distance. We will, however, need to be able to convert between units of volume and weight.

**Volume** is defined as the amount of space that a substance occupies. When we refer to volume, we are referring to liquid measure (ex. 5mL).

In the Metric System, Volume has two units:

- milliliters (mL) and liters (L).
- There are 1000mL in every 1L

**Weight** is defined as the heaviness of matter of a substance.

When we refer to weight, we are referring to solid measure (ex. 5g).

In the Metric System, Weight has four units:

- kilogram (kg), gram (g), milligram (mg), and microgram (mcg or µg)
- There are 1000mcg in 1mg, 1000mg in 1g, and 1000g in 1kg

The easiest way to convert between units in the Metric System is to *move the decimal point*. When we go from a larger unit to a smaller unit we will move the decimal 3 units to the right (LSR). When we move from a smaller unit to a larger unit we will move the decimal point 3 units to the left (SLL). Let’s take a look at a couple of examples:

4.48357L = ?mL
Larger to Smaller move Right (LSR)

4.483L ➞ 4483.57mL

25.754µg = ?g
Smaller to Larger move Left (SLL)

23.75µg ➞ 0.00002375g
We moved 6 places, µg to mg to g
The **Apothecary System** originates from a Greek system of measure. Much like the Metric System, it concerns itself with both weight and volume however many of the units in the Apothecary System have changed or been phased out.

There is a very small unit of weight known as a grain (gr).
Be sure to note that a gr (grain) ≠ g (gram).

1 grain (gr) = 64.8mg
You might be familiar with 5gr Tylenol® (325mg) or 10gr Tylenol® (650mg).

In respect to volume, there are two units – the fluid dram and the fluid ounce.

1 fluid dram ≈ 5mL and can be represented in the following ways:  
\[ \text{i} \] or 1fl dr.

1 fluid ounce ≈ 30mL can be shown as follows:  
\[ \text{vi} \] or 1 fl oz.

The number of drams or fluid ounces is reflected by the Roman numeral to the right of the appropriate symbol. 5 drams is shown as:  
\[ \text{vi} \]

The **Avoirdupois System** originates from France and is commonly used today in the United States to describe units of weight. This system, unlike the Metric System and Apothecary System, does not have any units of volume.

There is only one conversion factor that you’ll need to know for the Avoirdupois System:

1 pound (lb.) = 16 ounces (oz.)
Be sure to note that an oz. (solid) ≠ fl oz. (liquid).
Common Household Measurements include many measures used in both cooking and everyday life. This system only concerns volume (liquid measure).

<table>
<thead>
<tr>
<th>Unit</th>
<th>Abbreviation(s)</th>
<th>Conversion Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaspoonful</td>
<td>t or tsp</td>
<td>1t = 5mL</td>
</tr>
<tr>
<td>Tablespoonful</td>
<td>T or Tbsp</td>
<td>1T = 15mL</td>
</tr>
<tr>
<td>Fluid Ounce</td>
<td>fl oz.</td>
<td>1fl oz. = 29.57mL ≈ 30mL</td>
</tr>
<tr>
<td>Pint</td>
<td>pt</td>
<td>1pt = 473mL ≈ 480mL</td>
</tr>
<tr>
<td>Quart</td>
<td>qt</td>
<td>1qt = 2pt</td>
</tr>
<tr>
<td>Gallon</td>
<td>gal</td>
<td>1gal = 4qt</td>
</tr>
</tbody>
</table>

There are two systems of measure used to describe Temperature: Celsius and Fahrenheit. Celsius (centigrade) has been adopted in most countries and is based on the freezing point (0°C) and boiling point of water (100°C). Fahrenheit isn’t as easily scaled, but for perspective, the freezing point of water is 32°F and the boiling point of water is 212°F.

In order to convert between the two systems:

°F = (°C x 9/5) + 32

°C = °F - 32 x (5/9)

If you prefer to only remember one equation:

9 x °C = 5 x °F - 160
# Pharmaceutical Conversion Factors

<table>
<thead>
<tr>
<th>Exact Liquid Measure</th>
<th>Approximate Liquid Measure (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 units = 1 mL</td>
<td>n/a</td>
</tr>
<tr>
<td>20 gtts = 1 mL</td>
<td>n/a</td>
</tr>
<tr>
<td>1 cc or 1 cm³ = 1 mL</td>
<td>n/a</td>
</tr>
<tr>
<td>1 tsp = 5 mL</td>
<td>n/a</td>
</tr>
<tr>
<td>1 Tbsp = 15 mL</td>
<td>n/a</td>
</tr>
<tr>
<td>8 i = 5 mL</td>
<td>n/a</td>
</tr>
<tr>
<td>1 fl oz = 29.57 mL</td>
<td>1 fl oz ≈ 30 mL</td>
</tr>
<tr>
<td>8 i = 29.57 mL</td>
<td>8 i ≈ 30 mL</td>
</tr>
<tr>
<td>1 pt = 473 mL</td>
<td>n/a</td>
</tr>
<tr>
<td>1 qt = 946 mL</td>
<td>n/a</td>
</tr>
<tr>
<td>1 qt = 2 pt</td>
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</tr>
<tr>
<td>1 L = 1000 mL</td>
<td>n/a</td>
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<tr>
<td>1 gal = 3784 mL</td>
<td>1 gal ≈ 4000 mL</td>
</tr>
<tr>
<td>1 gal = 4 qt</td>
<td>n/a</td>
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</table>

<table>
<thead>
<tr>
<th>Exact Solid Measure</th>
<th>Approximate Solid Measure (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 mcg or 1000 µg = 1 mg</td>
<td>n/a</td>
</tr>
<tr>
<td>64.8 mg = 1 gr</td>
<td>65 mg ≈ 1 gr</td>
</tr>
<tr>
<td>1000 mg = 1 g</td>
<td>n/a</td>
</tr>
<tr>
<td>28.35 g = 1 oz</td>
<td>30 g ≈ 1 oz</td>
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<tr>
<td>454.54 g = 1 lb</td>
<td>480 g ≈ 1 lb</td>
</tr>
<tr>
<td>1000 g = 1 kg</td>
<td>n/a</td>
</tr>
<tr>
<td>2.2 lbs = 1 kg</td>
<td>n/a</td>
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</tbody>
</table>
The ability to convert between all of the systems listed so far in this guide is critical.

**Example A:** if a prescriber writes:

You’ll be tasked with dispensing the correct package size. While the patient and doctor measure insulin in units, pharmacy personnel dispense it in milliliters. Referring to the conversion table on the previous page,

1. You’ll find that there are 100 units in every 1 mL.
   This can be rewritten 100 units:1 mL.
2. Well we want to know how many mL there are in 10 u (per the prescription).
   That can be rewritten 10 units: X mL
3. Combine #1 and #2
   100 units: 1 mL::10 units: X mL
4. Now let’s translate that into something we can solve:
   
   \[
   \frac{100 \text{ units}}{1 \text{ mL}} = \frac{10 \text{ units}}{X \text{ mL}}
   \]
5. Cross-Multiply and Divide
   
   \[1 \text{ mL} \times 10 \text{ units} = 10 / 100 \text{ units} = 0.1 \text{ mL}\]
6. We’ve determined there are 0.1 mL for every 100 units
7. So now we know that the patient will administer 0.1 mL daily for 30 days (3.0 mL)

**Example B:**

? gtts = 8 mL

\[
\frac{20 \text{ gtts}}{1 \text{ mL}} = \frac{X \text{ gtts}}{8 \text{ mL}}
\]

1. Set up our conversion factor.
2. Set up our conversion.
3. Cross Multiply and Solve
   
   \[20 \text{ gtts} \times 8 \text{ mL} = 160 / 1 \text{ mL} = 160 \text{ gtts}\]
Example C:

\[ \frac{? \text{ lbs}}{24 \text{ kg}} = 1 \text{ kg} \]

1. Set up our conversion factor.
2. Set up our conversion.
3. Cross Multiply and Solve

\[ 2.2 \text{ lbs} \times 24 \text{ kg} = 52.8 \div 1 \text{ kg} = 52.8 \text{ lbs} \]

Example D:

\[ \frac{? \text{ mL}}{2 \text{ pt}} = 1 \text{ pt} \]

1. Set up our conversion factor.
2. Set up our conversion.
3. Cross Multiply and Solve

\[ 473 \text{ mL} \times 2 \text{ pt} = 976 \div 1 \text{ pt} = 976 \text{ mL} \]

Example E:

\[ \frac{? \text{ mg}}{1.5 \text{ gr}} = 1 \text{ gr} \]

1. Set up our conversion factor.
2. Set up our conversion.
3. Cross Multiply and Solve

\[ 64.8 \text{ mg} \times 1.5 \text{ gr} = 66.3 \div 1 \text{ gr} = 66.3 \text{ gr} \]

Keys to remember when setting up conversions:

- Put the conversion factor on the left
- Notice how the units line up, same units on top, same units on the bottom
- Cross Multiply the only two numbers that are across from one another
- Divide that answer by the last number remaining
- Your answer will be the same unit as your variable (X).
Occasionally, you’ll be tasked with converting between two types of measurement that we do not know the conversion factor for. Like if you were asked to find how many pints are in 3 Liters. These are known as **Two Step Conversions**, because you’ll have to complete two conversion equations in order to solve the original question.

\[ ?\text{pts} = 3\text{L} \]

- We know there are 473mL in every pint, and 1000mL in every Liter.
- Milliliters are what is known as our intermediary.
  - An intermediary is a unit we can convert to (in one step) with BOTH the given component of the conversion (3L) and the unknown (?pts).
- Here’s how it all plays out:
  1. Convert our known to our intermediary unit.

\[
\frac{1\text{L}}{1000\text{mL}} = \frac{3\text{L}}{X\text{mL}}
\]

We find that 3L = 3000mL.

2. Now that we know that we have 3000mL as our known, we can do the second step of the conversion:

\[
\frac{1\text{pt}}{473\text{mL}} = \frac{X\text{pt}}{3000\text{mL}}
\]

We find that there are 6.34 pints in 3000mL.

3. Our Solution: *There are 6.34 pts in 3L.*
More information on this topic, as well as EVERYTHING you’ll need to know to pass the Pharmacy Technician Certification Exam, can be found at www.RxTechExam.com

RxTechExam offers a completely online and self-paced courses that will ensure your success on the PTCE, without breaking the bank, or interrupting your busy schedule.

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