



How to Solve Drug Dosage Problems

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General Information

There are 3 different types of measurements you will encounter when dealing with medications: Household, Apothecary, and Metric.

Type	Number	Solids	Liquids
Household	Whole numbers and Fractions before unit. Ex: 1 ½ T	Teaspoons (tsp, t) Tablespoons (Tbs, T) Pounds (lb)	Drop (gtt) Ounce (oz) Cup (c) Pint (pt) Quart (qt) Glass
Apothecary	Whole numbers, Fractions, and Roman Numerals after unit. Ex: gr 15 ½ or dr iss	Grains (gr) Drams (dr)	Minum (m) Fluid Dram (dr)
Metric	Whole numbers and decimals before unit (always put a 0 in front of the decimal. Ex: 0.15 mL	Grams (g) Meter (m)	Liters (L)

Note: When more than one equivalent is learned for a unit, use the most common equivalent for the measure or use the number that divides equally without a remainder.

Common Conversion Factors

$$m 15 = 15 \text{ gtt} = 1 \text{ mL} = 1 \text{ cc}$$

$$4 \text{ mL} = \text{dr } 1$$

$$15 \text{ mL} = 3 \text{ t} = 1 \text{ T}$$

$$30 \text{ mL} = 1 \text{ oz}$$

$$1 \text{ oz} = \text{dr } 8$$

$$60 \text{ mg} = \text{gr } 1$$

$$1 \text{ g} = \text{gr } 15$$

$$2.54 \text{ cm} = 1 \text{ in}$$

$$2.2 \text{ lb} = 1 \text{ kg}$$

Roman	Numerals
½ = ss	5 = v
1 = I or i	10 = x
2 = II or ii	15 = xv
3 = III or iii	19 = xix [10 + (10-1)]
4 = IV or iv (i before v = 5-1)	20 = xx



Converting Between Units

In order to convert between units, you first begin with the unit you are given. You then **find a conversion factor** that relates the unit you have to begin with and the unit you need to convert to. Next, you multiply the unit you began with by the conversion factor you found. This calculation will give you the new unit.

Ex: **Convert 120 mg to gr**_____ .

1st: think of a conversion factor that relates mg and gr. **60 mg = gr 1** (This can be used as either 60 mg/gr 1 or gr 1/60 mg)

2nd: set up your multiplication equation.

$$120 \text{ mg} \times \frac{\text{gr } 1}{60 \text{ mg}} = \text{gr } \underline{\quad}$$

note: when using the conversion factor, always place the unit you need on top and the unit you begin with on the bottom.

3rd: Solve your equation.

Multiply 120 mg x gr 1, then divide by 60 mg.

$$120 \text{ mg} \times \text{gr } 1 = 120$$

$$120 \div 60 \text{ mg} = \text{gr } 2$$

Therefore: 120 mg = gr 2

If you **do not have a conversion factor** for the two units you are dealing with you may be able to go through another unit to get to the unit you need.

Ex: **Convert 3 t to** _____oz.

1st: Try to find a conversion factor that relates teaspoons to ounces. If you look at your list, you probably won't find one. However, we can convert from teaspoons to milliliters and then from milliliters to ounces. Therefore, we need two conversion factors: **3 t = 15 mL** and **1 oz = 30 mL**.

2nd: set up your equation

$$3 \text{ t} \times \frac{15 \text{ mL}}{3 \text{ t}} = \underline{\quad} \text{ mL}$$

$$\underline{\quad} \text{ mL} \times \frac{1 \text{ oz}}{30 \text{ mL}} = \text{m } \underline{\quad}$$

3rd: Solve the equations.

$$3 \text{ t} \times 15 \text{ mL} = 45$$

$$45 \div 3 \text{ t} = 15 \text{ mL}$$

$$15 \text{ mL} \times 1 \text{ oz} = 15$$

$$15 \div 30 \text{ mL} = 0.5 \text{ oz}$$

Therefore: 3 t = 0.5 oz



Converting Between Metric Units

When you convert between metric units, you do not have to multiply anything; you may simply move the decimal place.

Kilo	UNIT	Milli	Micro
Kilogram.....	Gram	Milligram.....	Microgram
Kiloliter.....	Liter	Milliliter.....	Microgram
Kilometer.....	Meter	Millimeter.....	Micrometer
1	1,000	1,000,000	1,000,000,000
0.000000001	0.000001	0.001	1.0

There are 3 decimal places between each; therefore you move your decimal places 3 spaces for each conversion.

Ex: Convert 25.3 g to _____mg

1st: There is only one space between g and mg, so that means I move the decimal place 3 spaces in the same direction as the chart: to the right.

2nd: 25.3 (move decimal → 3 places) = 25,300

Therefore: 25.3 g = 25,300 mg

Ex: Convert 346,720.2 mg to _____kg

1st: You use the same rules for converting from milligrams to kilograms. There are 2 spaces between kg and mg so you move your decimal 6 places (2 spaces x 3 decimal places each). In this case, according to the chart, we move the decimal to the left.

2nd: 346,720.2 (move decimal ← 6 spaces) = 0.3467202 kg

Therefore: 346,720 mg = 0.3467202 kg

Calculating Drug Dosages

When performing drug calculations, you may use one of 2 methods: **the Ratio-Proportion method** or the **Formula method**. Each of these works as well as the other. However, once you decide which you are more comfortable with, you should stick with that way and not try to switch back and forth between the two.

Ratio-Proportion:

- 1st: set up your proportion.
- 2nd: Multiply means and extremes
- 3rd: solve for “x” algebraically.

Formula:

$$\frac{D}{H} \times Q = \text{answer} \qquad \frac{\text{order}}{\text{available}} \times \text{unit} = \text{answer}$$

You use drug calculations when you are calculating the dose of a medication you need to give a patient when you already know the strength of medication that the patient needs.

Ex: If the doctor orders 20 mg of Benadryl and you have 10 mg tablets, how many will you give the patient?

Ratio-Proportion Method

We know that 10 mg = 1 tablet, and we need 20 mg in an unknown number of tablets.

So: **1st: set up equation.**

$$10 \text{ mg} : 1 \text{ tab} = 20 \text{ mg} : x \text{ tab}$$

Notice that on both sides of the equation, mg comes first, then tablets. This is very important. It doesn't matter which unit comes first, as long as they are in the same order on both sides of the equal sign.

2nd: Multiply means and extremes

$$10 \text{ mg} \cdot x \text{ tab} = 1 \text{ tab} \cdot 20 \text{ mg}$$

3rd: Solve algebraically.

$$10x = 20 \qquad \frac{10x}{10} = \frac{20}{10} \qquad x = 2$$

Formula Method

$$\frac{D}{H} \times Q = \text{_____} \qquad \frac{\text{order}}{\text{available}} \times \text{unit} = \text{_____}$$

$$\text{So: } \frac{20 \text{ mg}}{10 \text{ mg}} \times 1 \text{ tablet} = \underline{\underline{2 \text{ tablets}}}$$

Therefore: you would give the patient 2 tablets.

Other Formulas

Calculating BSA (m²)

$$\sqrt{\frac{\text{Lb} \times \text{in}}{3131}} \quad \text{or} \quad \sqrt{\frac{\text{kg} \times \text{cm}}{3600}} \quad \text{*Round to hundredths place}$$

Ex: If you know a patient weighs 140 lb and 62 inches tall, to calculate the BSA, you simply plug the numbers into the formula, then solve.

$$\frac{140 \text{ lb} \times 62 \text{ in}}{3,131}$$

$$140 \times 62 = 8,680 \quad 8,680 \div 3131 = 2.77 \quad \sqrt{2.77} = \mathbf{1.66 \text{ m}^2}$$

Calculating a child's dosage using an adult dosage

$$\frac{\text{Child's BSA}}{1.7 \text{ m}^2} \times \text{adult dosage} = \text{child's dosage} \quad \text{*round to hundredths place}$$

Ex: The normal adult dosage of a medication is 150 mg. You have a child that weighs 30 kg and is 120 cm. How much medication do you give the child?

1st: You must find the child's BSA. To do so, use the formula given above.

$$\frac{30 \text{ kg} \times 120 \text{ cm}}{3,600} = 1 \quad \sqrt{1} = 1$$

2nd: Use the child's dosage formula.

$$\frac{1 \text{ m}^2}{1.7 \text{ m}^2} \times 150 \text{ mg} = \mathbf{88.24 \text{ mg}}$$

Calculating Flow Rate in mL/h

$$\frac{\text{Total mL ordered}}{\text{Total h ordered}} = \text{mL/h (must round to a whole number)}$$

Ex: Calculate the flow rate for an IV of 1,820 mL Normal Saline IV to infuse in 15 h by controller. Flow rate = _____ ml/h

$$\frac{1,800 \text{ mL}}{15 \text{ h}} = 121.33 = \mathbf{120 \text{ mL/h}}$$



Calculating Flow Rate in gtt/min

$$\frac{\text{Volume (mL)}}{\text{Time (min)}} \times \text{drop factor (gtt/mL)} = \text{Rate (gtt/min)} \quad (\text{MUST be whole number})$$

Ex: The physician orders Lactated Ringer's IV at 150 mL/h. The drop factor is 15 gtt/min. Find the flow rate in gtt/min.

$$\frac{150 \text{ mL}}{60 \text{ min}} \times 15 \text{ gtt/min} = 37.5 = \mathbf{38 \text{ gtt/min}}$$

Converting from °F to °C or °C to °F

$$^{\circ}\text{F} = 1.8 (^{\circ}\text{C}) + 32$$

*Carry to hundredths and round to tenths

$$^{\circ}\text{C} = \frac{^{\circ}\text{F} - 32}{1.8}$$

Helpful Websites

There are many helpful websites when it comes to drug calculations. The following all have practice problems and solutions. We encourage you to use them to your advantage. After all, the best way to get good at something is to PRACTICE!

<http://nursesaregreat.com/articles/drugcal.htm>

http://www.testandcalc.com/drugcalc_legacy/index.asp

<http://www.unc.edu/~bangel/quiz/quiz5.htm>

<http://home.sc.rr.com/nurdosagecal/>

http://classes.kumc.edu/son/nurs420/clinical/basic_practice_.htm

<http://www.rncentral.com/library/quizzes/dc.html>

http://e-courses.cerritos.edu/rsantiago/drug_calculations.htm

<http://www.unisanet.unisa.edu.au/Information/12150info/Remediation%20Practice%20calcs%202004.doc>

<http://nursing.flinders.edu.au/students/studyaids/drugcalculations/page.php?id=1>