

Quick Review: Multiplying Fractions

In multiplication of fractions, it is not necessary to find a common denominator. Simply multiply straight across, top and bottom:

$$\frac{5}{7} \times \frac{3}{4} = \frac{15}{28}$$

It is also possible at times to reduce the numbers by cross canceling. Numbers diagonally across from each other in the problem can be divided by a common factor:

$$\frac{4}{9} \times \frac{3}{8}$$

In this problem, 4 and 8 can both be divided by 4, and 3 and 9 can both be divided by 3, so we cross cancel:

$$\begin{array}{ccc} 1 & & 1 \\ \cancel{4} & \times & \cancel{3} \\ \cancel{9} & & \cancel{8} \\ 3 & & 2 \end{array}$$

4 goes into 4 one time, so we cross out the 4 and write a 1 above it. 4 goes into 8 2 times, so we cross out the 8 and write a 2 below it. We divide 3 and 9 by 3 in the same fashion. Then we multiply what is left straight across:

$$\begin{array}{ccc} 1 \longrightarrow 1 & & \\ \cancel{4} & \times & \cancel{3} \\ \cancel{9} & & \cancel{8} \\ 3 \longrightarrow 2 & & \end{array} = \frac{1}{6}$$

Practice:

1. $\frac{4}{27}$ X $\frac{9}{16}$

2. $\frac{2}{3}$ X $\frac{3}{8}$

3. $\frac{5}{6}$ X $\frac{24}{25}$

4. $\frac{10}{27}$ X $\frac{12}{55}$

5. $\frac{15}{13}$ X $\frac{39}{40}$

6. $\frac{5}{7}$ X $\frac{6}{11}$

Answers:

1. $1/12$ 2. $1/4$ 3. $4/5$ 4. $8/99$ 5. $9/8$ or $1 1/8$ 6. $30/77$

Quick Review: Dividing Decimals

When dividing decimals such as: $41.64 \div 3.5$ (or $41.64 / 3.5$), we set the problem up and then move the decimal point to the end of the divisor (the number outside), and move the decimal over the same number of spaces in the dividend (the number inside). If the divisor already has the decimal point at the end (it isn't shown), then we leave it alone.

$$3.5 \overline{)41.64}$$

We then divide as usual, and we add zeros, as we need to once we get past the decimal point:

$$\begin{array}{r}
 11.8971 \\
 35 \overline{)416.4} \\
 \underline{35} \\
 66 \\
 \underline{35} \\
 314 \\
 \underline{280} \\
 340 \leftarrow \text{Add a zero to continue} \\
 \underline{315} \\
 250 \\
 \underline{245} \\
 50 \\
 \underline{35} \\
 15
 \end{array}$$

You can also divide a smaller number by a larger number this way : $3 \div 4$

$$4 \overline{)3.00}$$

simply by adding zeroes after the decimal point.

In some problems, you could keep dividing forever, so you will need to round off your answer, usually to the nearest hundredth or thousandth unless otherwise instructed. If the number next to the place you round off to is 5 or more, round up 1. If it is less than 5, leave the number as it is:

To the nearest hundredth:

$34.5\mathbf{6}17 = 34.5\mathbf{6}$ (the 6 is in the hundredths place, and the 1 next to the 6 was less than 5)

$5.\underline{6}7789 = 5.68$ (the 7 is in the hundredths place, and the 7 next to it is greater than 5, so we round up 1)

Practice: (round to the nearest hundredth)

1. $34.5 \div 5.1$

2. $5 \div 8$

3. $3.55 / 2.2$

4. $8 / 3$

5. $1 / 4$

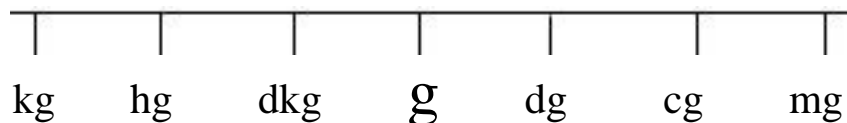
6. $35 \div 7.5$

7. $7.5 \div 35$

Answers:

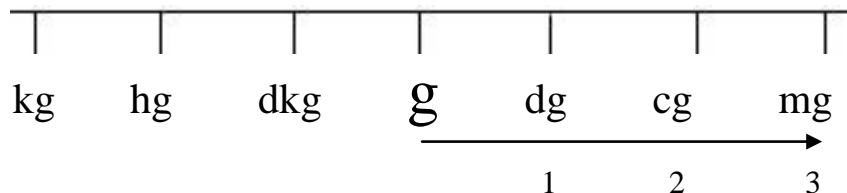
1. 6.76 2. 63 3. 1.61 4. 2.67 5. 25 6. 4.67 7. 21

Converting in the Metric System

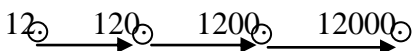


The above line represents the easiest way to convert units within the metric system. In the center is the basic unit; it could be grams (g), liters (l), or meters (m). The grams and liters are our main concern. In our example above, going to the left, the units get larger, with dekagrams (dkg, 10 grams), hectograms (hg, 100 grams), and kilograms (kg, 1000 grams). Going to the right, the units get smaller, with decigrams (dg, 1/10 of a gram), centigrams (cg, 1/100 of a gram), and milligrams (mg, 1/1000 of a gram). The convenient thing about the metric system is that it corresponds to decimal/place values in our number system (tenths, hundredths, thousandths, etc.). This means that changing from one unit to another is simply a matter of moving the decimal point left or right. We simply start out on the line with the unit we have, and count the number of places we move to get to the unit we want. We then move the decimal point the same number of places in the same direction, and the conversion is done.

For example, let's say we need to change 12 grams into milligrams. We start at grams on our line, and count over to milligrams:



We moved three places to the right, so we move the decimal point three places to the right. If we don't see the decimal point, we always assume it to be at the end of the number, so we have:



So 12 grams would equal 12,000 milligrams.

(One other important conversion to remember is that one cubic centimeter (cc) is equal to one milliliter.)

Practice:

1. 30 kg = ____ g
2. 4 g = ____ mg
3. 500 mg = ____ cg
4. 400 cc = ____ ml
5. 50 kg = ____ cg
6. 355.5 cc = ____ liters
7. 4 l = ____ cl
8. 5 kl = ____cc

Answers:

1. 03 2. 4000 3. 50 4. 400 5. 5,000,000 6. 355.5 7. 400 8. 5,000,000

Apothecary Measures

Unlike the metric system, the Apothecary system is not based on decimal/place value, so converting from Apothecary to metric involves more than moving a decimal point. We need to know the conversion factors, the small bits of information that tell us how many of one unit makes up another. The conversions for the most commonly used units are below:

gr= grain min= minum dr= dram oz= ounce T= tablespoon t= teaspoon

Another symbol used for ounce is \mathfrak{z} , and dram can be represented by \mathfrak{d} .

oz 1 = 30 ml
dr 1 = 1772 mg
1 T = 15 ml
1 t = 5 ml
gr 1 = 60 mg
60 drops = 4 ml

To convert back and forth, we'll use the above conversion factors as a fraction, such as:

$$\frac{\text{oz } 1}{30 \text{ ml}}$$

Technically, the top and bottom are equal, and any fraction where the numerator and denominator are the same is equal to 1. This is important because we can multiply any number by one at any time without violating any mathematical laws. This fact allows us to “legally” use the above type of fraction to change any Apothecary measure to metrics so long as we know the appropriate conversion factor.

Example:

We need to convert 6 grains into milligrams. So we take our conversion factor from the list above: gr 1 = 60 mg. Now we set up our fraction, with the unit we want to wind up with on top, and the unit we want to change from on the bottom:

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

We now take that fraction and multiply it by the amount we want to change, the 6 grains:

$$\frac{60 \text{ mg}}{\text{gr } 1} \times \frac{\text{gr } 6}{1}$$

We automatically place the gr 6 over 1 (as any whole number can be written as a fraction by putting it over 1). Now we multiply:

$$\frac{60 \text{ mg}}{\cancel{\text{gr}} 1} \times \frac{\cancel{\text{gr}} 6}{1} = \frac{360 \text{ mg}}{1}$$

The “gr”s cross cancel, leaving us with mg as our only remaining unit, just as we wanted. Thus, we now know gr 6 = 360 mg.

Practice:

1. 300 drops = ____ ml
2. gr 15 = _____ mg
3. 3 T = _____ ml
4. 4 oz = ____ ml
5. dr 4 = _____ mg

Answers:

1. 20 2. 1000 3. 45 4. 120 5. 7088

Dosage Calculations

The order is for 600mg of Mannitol IV. The vial available contains 12.5 g in 50 ml. To calculate the amount in milliliters required for the proper dosage, we use dimensional analysis.

In this case, though, we have one problem: the order is in milligrams, but the amount in the vial is measured in grams. Unless the units of measure match, the math will not work. Our first step is to convert the grams into milligrams, to match the order. To do this, we take 12.5 and move the decimal point over 3 places to the right (see the section on conversion). Thus, we have 12,500 milligrams in the 12.5 grams.

Now that our units match, we can proceed:

$$600\text{mg} \quad \times \quad \frac{50\text{ml}}{12,500 \text{ mg}}$$

There are a couple of quick checks you can use if you get confused on the placement of things. First, the amounts available always form the conversion part of the problem, one over the other, while the dosage ordered is always the part by itself on the other side of the multiplication symbol. Also, whatever unit you want to wind up with determines where things go. Look at the units in our problem without the numbers:

$$\frac{\text{mg}}{\text{mg}} \quad \times \quad \frac{\text{ml}}{\text{mg}}$$

We have one mg on the bottom and one mg on top and one on the bottom, so they cancel out.

$$\frac{\cancel{\text{mg}}}{\cancel{\text{mg}}} \quad \times \quad \frac{\text{ml}}{\cancel{\text{mg}}}$$

So you get left with only ml, the unit you want for your answer, and get rid of the mg, which you don't want left over.

So the two quick checks are:

1. The supply/given amounts always go one over the other in the division part of the formula.
2. The unit in the supply amount you want to be left with always goes on top.

And remember, the units must match. The volume your working with (liters, ml, cc) must match what is asked for; if you are to administer ml and the medication is available in liters, you must convert the liters to ml before you start your calculations. The same applies to the mass measures (grams, mg, mcg, etc.).

Practice:

1. If there are 5 grams of a medication in 3 ml of solution, how many ml are needed if 35 grams are required?
2. The doctor orders 7500 units of medication. The vial reads 10,000 units per ml. How many ml are needed?
3. The doctor orders 10,000 mg of medication; the bottle reads 2 grams per liter. How many ml should be given?
4. 0.5 g of a medication is required; the tablets available are marked 250 mg per tablet. How many tablets must be given?
5. A dose of 500 mcg is ordered; the strength available is 2000 mcg per ml. How much should be administered?
6. A dose of 1500 mcg is required; the medication is available in a 50 ml bottle containing 5 mg of medication. How much should be administered?

Answers:

1. 21 ml 2. 75 ml 3. 5 ml 4. 2 tablets 5. 25 ml 6. 3 ml