MOST DOSAGE CALCULATIONS require more than one equation. For example, the health care provider may order a drug in grains, but it may be available only in tablet, capsule, or liquid form in milligrams. When this happens, you need to convert from one measurement system to another before deciding how much medication to administer (see When You Need a New Measure).

Keeping in step
When converting between measurement systems, first consult a conversion table to find the standard equivalent value—the equivalent between the two measurement systems. Then use the ratio and proportion method to calculate the correct dose. Put the standard equivalent values in the first ratio or fraction and put the quantity ordered and the unknown quantity in the second ratio or fraction.

The examples here and on the next two pages show how to convert from one measurement system to another, then how to calculate the correct dose.

Wary of apothecaries’ units?
Suppose your patient’s order, written in apothecaries’ units, reads aspirin, gr x P.O. daily, but the unit-dose package says aspirin, 325 mg. How many tablets should you administer daily? Here’s how to solve this using fractions.

• In apothecaries’ units, “aspirin, gr x” indicates 10 grains of aspirin; 1 grain is equivalent to approximately 65 mg. Set up the first fraction with the standard equivalent values:

  \[
  \frac{65 \text{ mg}}{1 \text{ grain}}
  \]

• Set up the second fraction with the unknown quantity in the appropriate position:

  \[
  \frac{X}{10 \text{ grains}}
  \]

• Put these fractions into a proportion:

  \[
  \frac{65 \text{ mg}}{1 \text{ grain}} = \frac{X}{10 \text{ grains}}
  \]

• Cross multiply the fractions to set up an equation:

  \[
  65 \text{ mg} \times 10 \text{ grains} = X \times 1 \text{ grain}
  \]

• Solve for \( X \) by dividing both sides of the equation by 1 grain and canceling units.

Advice from the experts
When you need a new measure
To easily determine a dose when you must first convert to a different system of measurement, remember these tips:

• Read the drug order thoroughly, paying close attention to decimal places and zeros.
• Convert the dose from the system in which it’s ordered to the system in which it’s available.
• Calculate the number of capsules or tablets or the amount of solution needed to obtain the desired dose.
that appear in both the numerator and denominator:

\[
\frac{65 \text{ mg}}{1 \text{ grain}} \times \frac{10 \text{ grains}}{1 \text{ grain}} = X \times \frac{1 \text{ grain}}{1 \text{ grain}}
\]

\[X = 650 \text{ mg}\]

• The dose to be given is 650 mg. Now determine the number of tablets to give by setting up a proportion:

\[
\frac{X}{650 \text{ mg}} = \frac{1 \text{ tablet}}{325 \text{ mg}}
\]

• Cross multiply the fractions:

\[X \times 325 \text{ mg} = 1 \text{ tablet} \times 650 \text{ mg}\]

• Solve for \(X\) by dividing each side of the equation by 325 mg and canceling units that appear in both the numerator and denominator:

\[
\frac{X \times 325 \text{ mg}}{325 \text{ mg}} = \frac{1 \text{ tablet} \times 650 \text{ mg}}{325 \text{ mg}}
\]

\[X = 650 \text{ tablets} \times \frac{325}{325} = 2 \text{ tablets}\]

**Pondering a prescription**

A prescription reads phenobarbital, gr \(\frac{1}{4}\); take gr \(\frac{1}{2}\) t.i.d. P.O. daily. How many milligrams of phenobarbital should this patient receive? Here’s how to solve this using fractions.

• Convert “gr \(\frac{1}{4}\)” to milligrams by consulting a conversion table. As mentioned earlier, 1 grain equals approximately 65 mg.

• Set up the first fraction with the standard equivalent values:

\[
\frac{65 \text{ mg}}{1 \text{ grain}}
\]

• Set up the second fraction with the unknown quantity in the appropriate position:

\[
\frac{X}{\text{grain } \frac{1}{4}}
\]

• Put these fractions into an equation:

\[
\frac{65 \text{ mg}}{1 \text{ grain}} = \frac{X}{\text{grain } \frac{1}{4}}
\]

• Cross multiply the fractions:

\[65 \text{ mg} \times \text{grain } \frac{1}{4} = X \times 1 \text{ grain}\]

• Solve for \(X\) by dividing each side of the equation by 1 grain and canceling units that appear in both the numerator and denominator:

\[
\frac{65 \text{ mg} \times \text{grain } \frac{1}{4}}{1 \text{ grain}} = \frac{X \times 1 \text{ grain}}{1 \text{ grain}}
\]

\[X = 65 \text{ mg} \times \frac{1}{4}\]

\[X = 16.25 \text{ mg}\]

• Now we know that grain \(\frac{1}{4}\) equals 16.25 mg. However, the prescribed dose is grain \(\frac{1}{2}\). Calculate the number of milligrams to give the patient by setting up a proportion:

\[
\frac{X}{\text{grain } \frac{1}{2}} = \frac{16.25 \text{ mg}}{\text{grain } \frac{1}{4}}
\]

• Cross multiply the fractions:

\[X \times \text{grain } \frac{1}{4} = 16.25 \text{ mg} \times \text{grain } \frac{1}{2}\]

• Solve for \(X\) by dividing both sides of the equation by grain \(\frac{1}{4}\) and canceling units that appear in both the numerator and denominator:

\[
\frac{X \times \text{grain } \frac{1}{4}}{\text{grain } \frac{1}{4}} = \frac{16.25 \text{ mg} \times \text{grain } \frac{1}{2}}{\text{grain } \frac{1}{4}}
\]

\[X = 16.25 \text{ mg} \times \frac{1}{2}\]

\[X = 8.125 \text{ mg}\]

\[X = 32.5 \text{ mg}\]

The dose to be given is 32.5 mg.

**Digoxin dilemma**

Your patient receives a prescription for 62.5 mcg digoxin elixir, P.O. daily. The elixir label reads 0.05 mg/ml. How many milliliters of digoxin should you give? Here’s how to solve this using ratios.

• Convert micrograms to milligrams (1,000 mcg equals 1 mg).

• Set up the first ratio with milligrams (1,000 mcg equals 1 mg).

• Set up the second ratio with the unknown quantity in the appropriate position:

\[
\frac{X}{1 \text{ mg}} = \frac{62.5 \text{ mcg}}{1,000 \text{ mcg}}
\]

\[X = 0.0625 \text{ mg}\]

\[X = 0.0625 \text{ mg} \times 1,000 \text{ mcg} = 62.5 \text{ mcg}\]
• Put these ratios into a proportion:
  1 mg:1,000 mcg::X:62.5 mcg

• Multiply the means and the extremes:
  \[ X \times 1,000 \text{ mcg} = 1 \text{ mg} \times 62.5 \text{ mcg} \]

• Solve for X by dividing both sides of the equation by 1,000 mcg and canceling units that appear in both the numerator and denominator:
  \[ \frac{X \times 1,000 \text{ mcg}}{1,000 \text{ mcg}} = \frac{1 \text{ mg} \times 62.5 \text{ mcg}}{1,000 \text{ mcg}} \]
  \[ X = \frac{62.5 \text{ mg}}{1,000} \]
  \[ X = 0.0625 \text{ mg} \]

• The prescribed dose is 62.5 mcg, or 0.0625 mg. Calculate the number of milliliters to be given by setting up a proportion:
  \[ 0.0625 \text{ mg} : X : 0.05 \text{ mg} : 1 \text{ ml} \]

• Set up an equation by multiplying the means and the extremes:
  \[ X \times 0.05 \text{ mg} = 1 \text{ ml} \times 0.0625 \text{ mg} \]

• Solve for X by dividing each side of the equation by 0.05 mg and canceling units that appear in both the numerator and denominator:
  \[ \frac{X \times 0.05 \text{ mg}}{0.05 \text{ mg}} = \frac{1 \text{ ml} \times 0.0625 \text{ mg}}{0.05 \text{ mg}} \]
  \[ X = 1.25 \text{ ml} \]

The dose to be given is 1.25 ml.

The desired-over-have method
The desired-over-have method is another way to solve two-step problems. This method uses fractions to express the known and unknown quantities in proportions:

\[ \frac{\text{amount desired}}{\text{amount you have}} = \frac{\text{equivalent amount desired}}{\text{equivalent amount you have}} \]

Make sure the units of measure used in the numerator and denominator of the first fraction correspond to the units of measure in the numerator and denominator of the second fraction.

The following problem shows how to use the desired-over-have method.

**Potassium chloride puzzler**
The prescriber orders 60 mEq, potassium chloride liquid as a one-time dose, but the only solution on hand contains 20 mEq/15 ml. How many tablespoons (tbs) should you give the patient? Here’s the calculation.

• Convert milliliters to tablespoons by consulting a conversion table; 15 ml equals 1 tbs. Therefore, 20 mEq of the solution on hand equals 1 tbs.

• Set up the first fraction with the amount desired over the amount you have:
  \[ \frac{60 \text{ mEq}}{20 \text{ mEq}} \]

• Set up the second fraction with the unknown amount desired—represented by X—in the appropriate position:
  \[ \frac{X}{1 \text{ tbs}} \]

• Put these fractions into a proportion:
  \[ \frac{X \text{ desired}}{1 \text{ tbs have}} = \frac{60 \text{ mEq desired}}{20 \text{ mEq have}} \]

• Solve for X:
  \[ X = \frac{1 \text{ tbs} \times 60 \text{ mEq}}{20 \text{ mEq}} \]
  \[ X = 3 \text{ tbs} \]

The patient should receive 3 tablespoons of potassium chloride liquid.