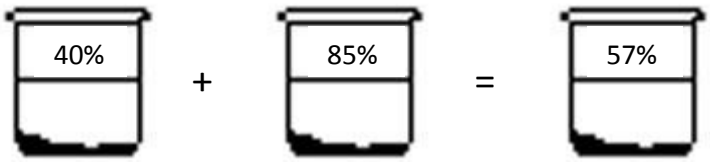
Mixture Problems

The purpose of this handout is to give a few tips to help when solving mixture problems: a chemist mixing up a solution or someone mixing two products together.

One very important, and sometimes difficult, part of these problems is knowing how to set them up. Let's look at an example. Suppose a chemist has 15 L of a 40% HNO_3 solution. He needs to know how much of an 85% HNO_3 solution he would have to add to the 40% solution to get a 57% HNO_3 solution. Round the answer to the nearest hundredth if necessary. Let's look at a method to organize this information.

One way is to draw out the beakers the chemist is using, like this:



15 L x L (15 + x) L

You then put the information given in the beakers as shown. The percents go inside; the amounts go outside. Notice that the amount for the 57% solution is just the amount of the 40% solution—15—plus the amount of the 85% solution—x. Now you have a good place to start to write the equation. To do so, just multiply each percent by the amount in the beaker above it like this:

$$.40(15) + .85x = .57(15 + x)$$

Notice that we put the percents in decimal form.

Now we solve for x. The steps are shown below.

$$6 + .85x = 8.55 + .57x$$ Times .40 by 15 and distribute .57 into the parenthesis.-

$$6 - 6 + .85x - .57x = 8.55 - 6 + .57x - .57x$$ Subtract 6 and .57x from both sides.

$$.28x = 2.55$$

$$\frac{.28}{.28}x = \frac{2.55}{.28}$$ Divide both sides by .28.

$$x = 9.11$$ Round to nearest hundredth.

So, the chemist needs to add 9.11 L of the 85% solution to get a 57% solution.

Let's now look at another example where two different products are being mixed. They are set up and solved much like the chemistry problems.

Suppose a store keeper wants to make a mixture of cashews and peanuts. He has on hand peanuts that cost $3 per pound and cashews that cost $5.50 per pound. He wants to make a 3 pound mixture that costs $4 per pound.

First, like before, let's draw it out. You can draw boxes or anything you like. This time put dollar amounts where you put percents in the last problem.

$3	+	$5.50	=	$4
x lb		(3 – x) lb		3 lb

So, now we have the prices in the boxes, and the amounts below them. You'll notice that for the amount of cashews we put 3-x instead of y or any other variable. This is because we need everything to be in terms of just one variable—either x or y. This is one of the **most important things** to note when solving problems. **Simply put the total amount minus x for the amount of the second thing being mixed when the total amount is given**. It will make your life much easier.

We now do the same as before. Multiply each amount by the price in the box above it.

$$3x + 5.50(3 - x) = 4(3)$$

From here, you solve for x as before. Shown below are the steps.

$$3x + 16.5 - 5.5x = 12$$ Distribute 5.5 and times 4 by 3

$$-2.5x + 16.5 = 12$$ Combine like terms.

$$-2.5x + 16.5 - 16.5 = 12 - 16.5$$ Subtract 16.5 from both sides.

$$-2.5x = -4.5$$

$$\frac{-2.5}{-2.5}x = \frac{-4.5}{-2.5}$$ Divide both sides by -2.5

$$x = 1.8$$

You need 1.8 pounds of peanuts, but how many pounds of cashews do you need? To find that, simply subtract 1.8 from 3.

$$3 - 1.8 = 1.2$$

You need 1.2 pounds of cashews.