Online Math Center

Mixture Problems from Elementary Algebra I

There are six steps that may be used to solve a mixture problem:

1. What is being mixed?

2. Organize the information.

3. Set up gallons of ingredient for each container.

4. Form a mixture equation.

5. Solve the equation.

6. Check the results

Example,

"How many gallons of a 60% solution must be added to 30 gallons of a 10% solution in order to produce a 20% solution?"

WHAT IS BEING MIXED?

Begin by asking "what is being mixed and how much of each?"

In the question above,

We are mixing a "60%" solution with a "10%" solution.

We do NOT know how much of the 60% solution we have, so we call the amount "x".

The units are gallons since the question mentions "gallons".

We also know that we have 30 gallons of the 10% solution.

ORGANIZE THE INFORMATION

The next step is to ORGANIZE the information.

This jar contains the 60% solution.	This jar contains the 10% solution.	This is the 20% solution jar. We combine the other two jars here.
"x" gallons	"30" gallons	"x + 30" gallons

When you combine "x" gallons with "30" gallons, the total is "x + 30" gallons.

The jar on the right is where we "mix" the liquids.

The jar on the right is also the place where we want to have the "20%" solution created.

SET UP GALLONS OF INGREDIENT FOR EACH CONTAINER.

A solution consists of a blend of different ingredients.

Look at the contents of any soda can and you will see all sorts of liquids blended together.

In the first jar when we are told that we have a "60%" solution, this means that 60% of the gallons in it are one particular liquid. The other "40%" of the container consists of all sorts of other ingredients.

Calculate the gallons of the ingredient in each of the containers by multiplying the total gallons of EACH container by the percentage listed for the container.

For example, in the first jar we multiply the total gallons (x) by 60% in order to find how many gallons of the one ingredient are in the container.

Ingredient: 60% of "x"	Ingredient: 10% of "30"	Ingredient: 20% of "x + 30"
(60%)(x)	(10%)(30)	(20%)(x + 30)
Jar 1	Jar 2	Jar 3

FORM A MIXTURE EQUATION

Since we are pouring the first two containers into the third, we have Jar 1 mixed with Jar 2 equals Jar 3

Thus, our "verbal" equation is:
(Ingredient in Jar 1) + (Ingredient in Jar 2) = (Ingredient in Jar 3)

So our mathematical **MIXTURE EQUATION** is

$(60\%)(x) + (10\%)(30) = (20\%)(x + 30)$

Once again, notice that we have mixed the gallons of the ingredient in Jar 1 with the gallons of the same ingredient found in Jar 2. The mixing occurred in Jar 3. This is how the mixture equation was created.

SOLVE THE EQUATION

We can now solve the equation we created.

Remember we are trying to find the value of "x", the gallons of 60% solution.

$(60\%)(x) + (10\%)(30) = (20\%)(x + 30)$

Don't forget that 60% is written as .60 using decimals

$(.60)(x) + (.10)(30) = (.20)(x + 30)$

$.60x + 3 = (.20)(x)+ (.20)(30)$

$.60x + 3 = .20x + 6$

$.60x - .20x + 3 = .20x - .20x + 6$

$.40x + 3 = 6$

$.40x + 3 - 3 = 6 - 3$

$.40x = 3$

$\frac{.40x}{.40} = \frac{3}{.40}$

$x = 7.5$

Hence, we add 7.5 gallons of the 60% solution to the 30 gallons of the 10% solution.

This will create 37.5 gallons of a mixture that is 20% solution.

CHECK THE RESULTS

Since x is 7.5, is it true that:

(60%)(x) + (10%)(30) = (20%)(x + 30) ?

Here we go with the check:

(60%)(7.5) + (10%)(30) =? (20%)(7.5 + 30)

(.60)(7.5) + (.10)(30) =? (.20) (7.5 + 30)

(.60)(7.5) + (.10)(30) =? (.20) (37.5)

4.5 + 3 =? 7.5

7.5 = 7.5
The answer checks

One more example.....

Example,

"How many gallons of a 12% solution must be added to a 20% solution in order to produce 10 gallons of a 14% solution?"

WHAT IS BEING MIXED?

We are mixing a "12%" solution with a "20%" solution.

We do NOT know how much of the 12% solution we have, so we call the amount "x".

We know that by mixing we will produce a total of 10 gallons, so if we subtract the "x" from the total 10 gallons we will have the amount in the other container. " 10 - x " is the number of gallons of 20% solution.

ORGANIZE THE INFORMATION
and SET UP GALLONS OF INGREDIENT FOR EACH CONTAINER.

The next step is to ORGANIZE the information.

This jar contains the 12% solution.	This jar contains the 20% solution.	This is the 14% solution jar. We combine the other two jars here.
"x" gallons	"10-x" gallons	"10" gallons
(12%)(x)	(20%)(10-x)	(14%)(10)
Jar 1	Jar 2	Jar 3

The expressions in color are the gallons of the ingredient we are using.

FORM A MIXTURE EQUATION

Since we are pouring the first two containers into the third, we have Jar 1 mixed with Jar 2 equals Jar 3

Thus,
(Ingredient in Jar 1) + (Ingredient in Jar 2) = (Ingredient in Jar 3)

So our **MIXTURE EQUATION** is

(12%)(x) + (20%)(10-x) = (14%)(10)

Once again, notice that we have mixed the gallons of the ingredient in Jar 1 with the gallons of the same ingredient found in Jar 2. The mixing occurred in Jar 3. This is how the mixture equation was created.

SOLVE THE EQUATION

We can now solve the equation we created.

(12%)(x) + (20%)(10-x) = (14%)(10)

Recall that 12% is written as .12 using decimals.

(.12)(x) + (.20)(10-x) = (.14)(10)

(.12)(x) + (.20)(10)- (.20)(x) = (.14)(10)

.12 x + 2 - .20x =1.4

Now solve for x:

$2 - .08x = 1.4$

$2 - 2 - .08x = 1.4 - 2$

$-.08x = -0.6$

$$\frac{-.08x}{-.08} = \frac{-0.6}{-.08}$$

$$x = 7.5$$

CHECK THE RESULTS

Since x is 7.5, is it true that

$(12\%)(x) + (20\%)(10-x) = (14\%)(10)$?

Here is the check:

$(12\%)(7.5) + (20\%)(10-7.5) =? (14\%)(10)$

$(12\%)(7.5) + (20\%)(2.5) =? (14\%)(10)$

$(.12)(7.5) + (.20)(2.5) =? (.14)(10)$

$0.9 + 0.5 =? 1.4$

$1.4 = 1.4$

The answer checks. Hence we add 7.5 gallons of a 12% solution to 2.5 gallons of a 20% solution to produce 10 gallons of a 14% solution.