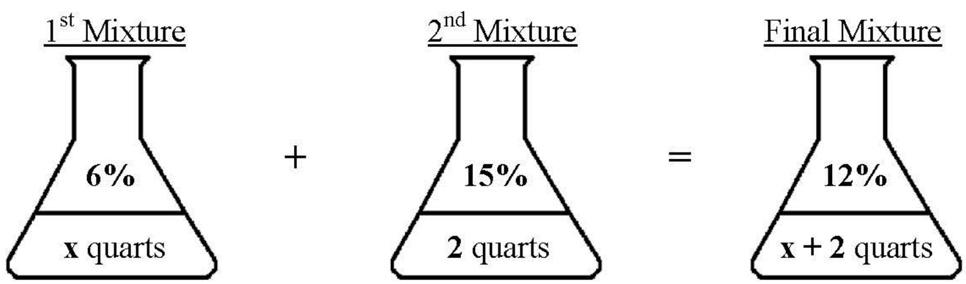
# Mixture Problems

Here are a few tips to remember when solving mixture problems:

1. Construct a table showing the given information. It may also be helpful to sketch a diagram similar to the diagram below in order to illustrate the given quantities.
2. Use the variable **x** to represent the **unknown** volume or amount of a mixture.
3. The volume of the first mixture plus the volume of the second mixture will be equal to the total volume of the final mixture.
4. The equation will be obtained by **summing** the volume of pure substance contained in each mixture, and setting this sum equal to the volume of pure substance contained in the final mixture. To find the volume of pure substance contained in a mixture, multiply the given percentage (%) by the corresponding volume of the mixture.

**Example:** A mixture containing 6% boric acid is to be mixed with 2 quarts of a mixture that is 15% acid, in order to obtain a solution that is 12% acid. How much of the 6% solution must be used?

**Draw a diagram**




Let **x** = quarts of 6% solution.

| | Percentage (%) | Volume (quarts) | Pure Substance = % * quarts |
|---|---|---|---|
| **1st Mixture** | 6 | x | 6x |
| **2nd Mixture** | 15 | 2 | 15(2) |
| **Final Mixture** | 12 | x + 2 | 12(x + 2) |

## Explanation:

The amount of **pure substance** (last column) in each mixture is determined by multiplying each **percentage** by its corresponding **volume**. The equation is then formed by **adding** the first two entries of the "**Pure Substance**" column and setting this sum **equal** to the last entry of that column.

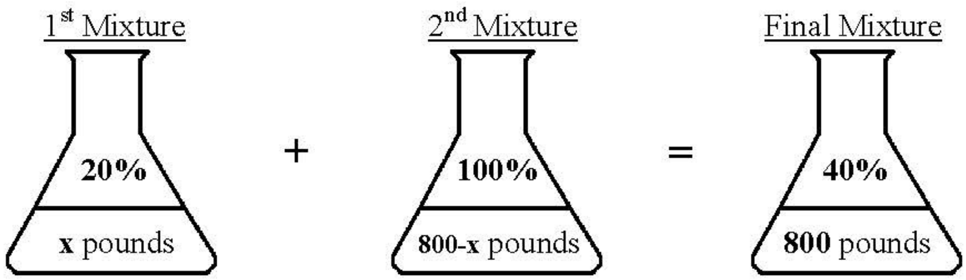
**Equation:**

$$6x + 15(2) = 12(x + 2)$$
$$6x + 30 = 12x + 24$$
$$-6x = -6$$
$$x = 1$$

***1 quart*** of the 6% solution must be used.

**Sample Problems:**

1. If alloy containing 20% silver is mixed with **pure** silver to get 800 pounds of 40% alloy, how much of the 20% alloy and pure silver must be used?




Let **x** = pounds of 20% alloy.

| | **Percentage (%)** | **Volume** (pounds) | **Pure Substance** = % * pounds |
|---|---|---|---|
| **1st Mixture** | 20 | x | 20x |
| **2nd Mixture** (pure) | **100** | 800 - x | 100(800 – x) |
| **Final Mixture** | 40 | 800 | 40(800) |

**Equation:**

$20x + 100(800 - x) = 40(800)$
$20x + 80000 – 100x = 32000$
$-80x + 80000 = 32000$
$-80x = -48000$
$x = 600$

Since x represents the volume of the 20% alloy, we need ***600 pounds*** of 20% alloy. The volume of pure silver needed is represented by 800 – x. We will therefore need ***200 pounds*** of pure silver.

Comment: 800 - x = 800 - 600

2. Dr. Lytle orders 20 grams of a 52% solution of a certain medicine. The pharmacist has only bottles of 40% and bottles of 70% solution. How much of each must be used to obtain the 20 grams of the 52% solution?

Let **x** = grams of the 40% solution.

| | **Percentage (%)** | **Volume** (grams) | **Pure Substance** = % * grams |
|---|---|---|---|
| **1st Mixture** | 40 | x | 40x |
| **2nd Mixture** | 70 | 20 - x | 70(20 – x) |
| **Final Mixture** | 52 | 20 | 52(20) |

**Equation:**

$40x + 70(20 - x) = 52(20)$
$40x + 1400 – 70x = 1040$
$-30x + 1400 = 1040$
$-30x = -360$
$x = 12$

***12 grams*** of the 40% solution must be used, since x represents the volume of 40% solution. The volume of the 70% solution that must be used is ***8 grams***. Comment: 20 - x = 20 - 12

3. Bryan discovers at the end of the summer that his radiator antifreeze solution has dropped below the safe level. If the radiator contains 4 gallons of a 25% solution, how many gallons of **pure** antifreeze must he add to bring it up to a desired 50% solution?

Let **x** = gallons of pure antifreeze.

| | Percentage (%) | Volume (gallons) | Pure Substance = % * gallons |
|---|---|---|---|
| **1st Mixture** | 25 | 4 | 25(4) |
| **2nd Mixture** (pure) | **100** | x | 100x |
| **Final Mixture** | 50 | x + 4 | 50(x + 4) |

**Equation:** $25(4) + 100x = 50(x + 4)$

$100 + 100x = 50x + 200$

$50x = 100$

$x = 2$

He will need to add ***2 gallons*** of pure antifreeze to obtain the desired 50% solution.

4. Ms. Hardy has 25 ounces of a 20% boric acid solution that she wishes to dilute to a 10% solution. How much **water** does she have to add in order to obtain the 10% solution?

Let **x** = ounces of water. Since water contains no boric acid, we will use **0** to represent the **percentage** for water.

| | Percentage (%) | Volume (ounces) | Pure Substance = % * ounces |
|---|---|---|---|
| **1st Mixture** | 20 | 25 | 20(25) |
| **2nd Mixture** | **0** | x | 0x |
| **Final Mixture** | 10 | x + 25 | 10(x + 25) |

**Equation:** $20(25) + 0x = 10(x + 25)$

$500 = 10x + 250$

$-10x = -250$

$x = 25$

She should add ***25 ounces*** of water to obtain the 10% solution.

5. A candy shop owner wishes to sell a bag containing two different kinds of candy. If Candy A costs \$0.40 per pound and Candy B costs \$0.70 per pound, how many pounds of Candy A must the shop owner add to 6 pounds of Candy B, if he wishes to sell the mixture for \$0.55 per pound?

Let **x** = pounds of Candy A.

| | **Cost (\$)** per pound | **Volume (pounds)** | **Total Cost** = \$ * pounds |
|---|---|---|---|
| **Candy A** | .40 | x | .40x |
| **Candy B** | .70 | 6 | .70(6) |
| **Final Mixture** | .55 | x + 6 | .55(x + 6) |

**Equation:**

$.40x + .70(6) = .55(x + 6)$

$.40x + 4.2 = .55x + 3.3$

$-.15x = -.9$

$x = 6$

The shop owner should add **6 *pounds*** of Candy A to Candy B.