

Mixture Questions

1. Ten gallons of a 30% acid mixture is obtained by mixing a 20% solution with a 50% solution. How much of each must be used?

Answer: Let x = the amount of 20% solution
Let y = the amount of 50% solution

$$\begin{cases} x + y = 10 \\ 0.20x + 0.50y = 0.30(10) \end{cases}$$

$$\begin{cases} x + y = 10 \\ 0.20x + 0.50y = 3 \end{cases} \quad \begin{cases} -0.20x - 0.20y = -2 \\ 0.20x + 0.50y = 3 \end{cases}$$

$$0.30y = 1$$

$$Y = 3.33$$

$$X + y = 10$$

$$X + 3.33 = 10$$

$$X = 6.67$$

Answer: 3.3 gallons of the 50% solution and 6.7 gallons of the 20% solution.

2. You need a 15% acid solution for a certain test, but your supplier only ships a 10% solution and a 30% solution. Rather than pay the hefty surcharge to have the supplier make a 15% solution, you decide to mix 10% solution with 30% solution, to make your own 15% solution. You need 10 liters of the 15% acid solution. How many liters of 10% solution and 30% solution should you use?

Answer: Let x stand for the number of liters of 10% solution,
Let y stand for the number of liters of 30% solution.

$$x + y = 10$$

$$0.10x = 0.30y = 0.15(10)$$

$$0.10(10 - y) + 0.30y = 1.5$$

$$1 - 0.10y + 0.30y = 1.5$$

$$1 + 0.20y = 1.5$$

$$0.20y = 0.5$$

$$y = \frac{0.5}{0.20} = 2.5$$

$$x = 10 - y = 10 - 2.5 = 7.5$$

Then we need **2.5 liters of the 30% solution, 7.5 liters of the 10% solution.**

3. How many kilograms of a 45% copper alloy and 60% copper alloy must be mixed together to form 62 kg of an alloy, which is 50% copper?

Let x = amount of 45% alloy

Let y = amount of 60% alloy

$$\begin{cases} x + y = 62 \\ 0.45x + 0.60y = 0.50(62) \end{cases}$$

SOLVE using elimination, substitution or matrices.

4. How many quarts each of a 62% poison solution and a 6% poison solution must a detective mix to get 14 quarts of a solution that is 30% poison?

Let x represent the quarts of the 62% poison.

Let y represent the quarts of the 6% poison.

$$x + y = 14$$

$$0.62x + 0.06y = 14(0.30) \rightarrow 0.62x + 0.06y = 4.2$$

$$\begin{array}{rcl}
 x + y = 14 & (\text{times } -0.62) \Rightarrow & -0.62x - 0.62y = -8.68 \\
 0.62x + 0.06y = 4.2 & (\text{leave alone}) \Rightarrow & 0.62x + 0.06y = 4.2 \\
 \hline
 \text{Adding} \Rightarrow & & 0 - 0.56y = -4.48 \\
 \Rightarrow & & y = 8
 \end{array}$$

Since y stood for the quarts of the 6% solution, we see that the detective needs 8 quarts of the 6% solution. Moreover, since $x + y = 14$, we see that $x + 8 = 14 \Rightarrow x = 6$, which means that the detective also needs 6 quarts of the 62% solution.

6 quarts of the 62% poison, &
8 quarts of the 6% poison

5. A 12% brine solution was mixed with a 16% brine solution to produce a 15% brine solution. How much of the 12% solution and how much of the 16% solution were used to produce 40 L of the 15% solution?