Solutions for Algebra 2

Background Information: A *solution* is made up of two parts a solute and a solvent. The *solute* is the substance that is dissolved into the solvent, usually water. The solute is generally the smallest portion of a solution. Solutions are quantitatively described by concentration. *Concentration* is the amount of solute per give amount of solvent or solution. Concentration is generally described as a percentage or in molarity. *Molarity* is a chemistry term that describes the concentration in terms of number of moles of solute per liter of solution. You will focus on molarity more in chemistry. For this lesson we will focus on concentration in terms of percentages.

If you have a 10% alcohol solution, then 10% is alcohol and 90% is water. Likewise, if you have a 10M alcohol solution, then 10 moles of alcohol is in 1 L of solution. Volumes are not always additive, but for our purposes you may assume they are. This would mean a 10% alcohol solution will have 10 mL of alcohol and 90 mL of water.

Making solutions can be a little more complicated if you want to use solutions you have already made instead of starting from scratch.

For example:
You have a 10% and a 5% solution of alcohol and you want to make 100 mL of a 7% solution. What volume of each solution do you need to make the desired concentration?

In order to solve this problem, you will need a system of equations. One equation will represent the volumes of each solution and the other will represent the combining of solutions.

Volumes: Since you know you need a total of 100 ml then you know the volume of the 10% (x) and the volume of the 5% (y) solution must add up to 100, so you get the following equation:

$$X + Y = 100$$

Combining: Since you know combining some amount of the two solutions will make 100mL of a 7% solution you can set up the following equation:

$$10X + 5Y = 7(100)$$

Solving the System: solve one equation for X and substitute it for X in the other equation.

$$X = 100-Y$$
$$10(100-Y) + 5Y = 700$$
$$1000 - 10Y + 5Y = 700$$
$$-5Y = -300$$
$$Y = 60$$
$$X + Y = 100$$
$$X + 60 = 100$$
$$X = 40$$

Solution: You need to mix 40 mL of the 10% solution with 60 mL of the 5% solution in order to get 100mL of a 7% solution.

Group Practice Problems:

1. Alex has added 3 liters of alcohol to 7 liters of a 22% sugar in alcohol solution. What is the sugar concentration of the resulting solution?

2. Stacy mixed 25 grams of salt with 400 grams of a 13% salt solution in water. What is the percentage of salt in his new solution?

3. What is the concentration of salt in the solution obtained by mixing 75 ml of water with 280 ml of a 33% salt solution in water?

4. Kasey has added 2.5 quarts of an alcohol in water solution to 3 quart of water and her ending product is a 55% alcohol in water solution. What was the concentration of the 4 quarts of alcohol solution that was added?

5. Megan wishes to increase the percent of salt in 125 ml of a 35% acid solution in water to 65% acid, how much salt must she add?

6. Victor has 34 kg of pinto beans which cost $1.50 per kilogram. How many kilograms of kidney beans at $1.09 per kilogram should be added for the complete mixture to have a value of $95.00?

7. Mark's teacher has asked him to add acid to 18 gallons of a 12% acid in water solution to get a solution which is 75% acid. How much pure acid should he add?

8. How many ounces of water should be evaporated from 75 ounces of a 5% salt solution in order to make a 25% salt solution?

Independent Practice Problems:

9. 5 liters of alcohol are added to 12 liters of a 58% sugar in alcohol solution. What is the sugar concentration of the resulting solution?

10. 45 grams of salt with 330 grams of a 15% salt solution in water. What is the percent of salt in this new solution?

11. What is the concentration of sugar in the solution obtained by mixing 225 ml of water with 425 ml of a 40% salt solution in water?

12. Victor has 60 kg of pinto beans which cost $0.69 per kilogram. How many kilograms of kidney beans at $0.89 per kilogram should be added for the complete mixture to have a value of $101.00?

13. How many ounces of water should be evaporated from 240 ounces of a 34% salt solution in order to make a 65% salt solution?