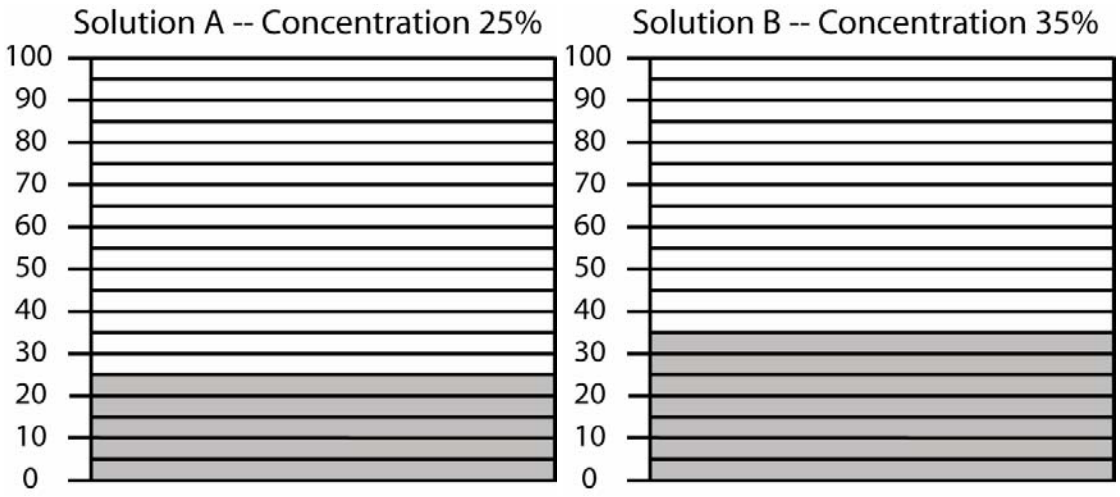
Mixture problems: Salt concentration NAME:

This worksheet will help us understand mixture problems that involve combining liquids of different concentrations to form a final mixture of another concentration.

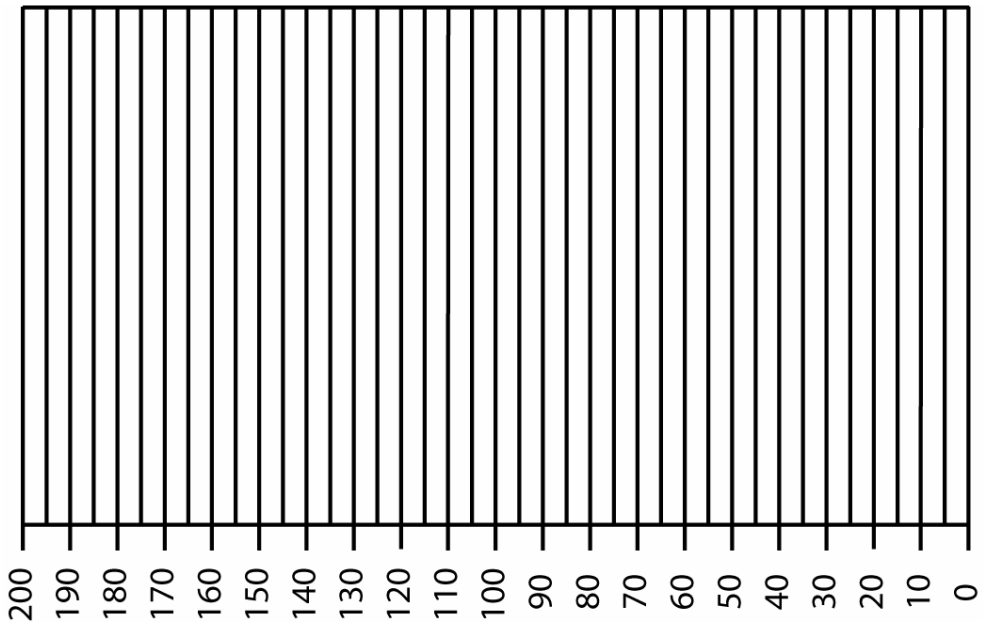
Consider two salt solutions, Solution A and Solution B. Solution A is a 25% salt solution and Solution B is a 35% salt solution. This means that out of every 100 gallons of Solution A, there are 25 gallons of pure salt and 75 gallons of water. Likewise, Solution B has 35 gallons of pure salt and 65 gallons of water for every 100 gallons of solution.

To understand this, I like to picture the salt settling down to the bottom of the jug. The following pictures illustrate two 100-gallon jugs, one with Solution A and one with Solution B. The pure salt has settled to the bottom as the gray material. The white area is pure water.



Let's say we combine these two jugs. We'd make 200 gallons of salt solution. What will the new concentration be? Will it be 25% or 35%? Or neither? Could it be anything? So, let's combine those two jugs into this bigger jug. Shade in the gallons of pure salt from the two jugs above as if it settled to the bottom of this 200-gallon jug (picture below). What is the final concentration of the mixture?

Remember the concentration is found by dividing the amount of pure salt by the total amount of stuff (salt and water).

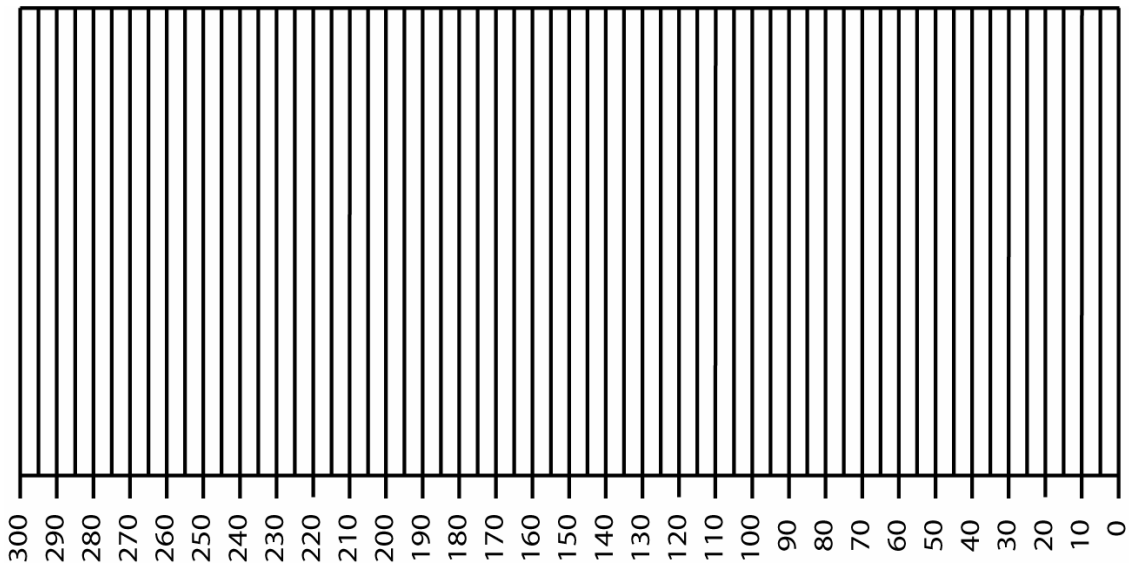


To better understand the relationship between the amounts of each solution we add and the final concentration, we'll play with them a bit.

Let's say we mix 100 gallons of Solution A and 200 gallons of Solution B.

Shade the salt in the 300-gallon jug to the right. Remember to shade twice as much for Solution B since you are adding 200 gallons this time.

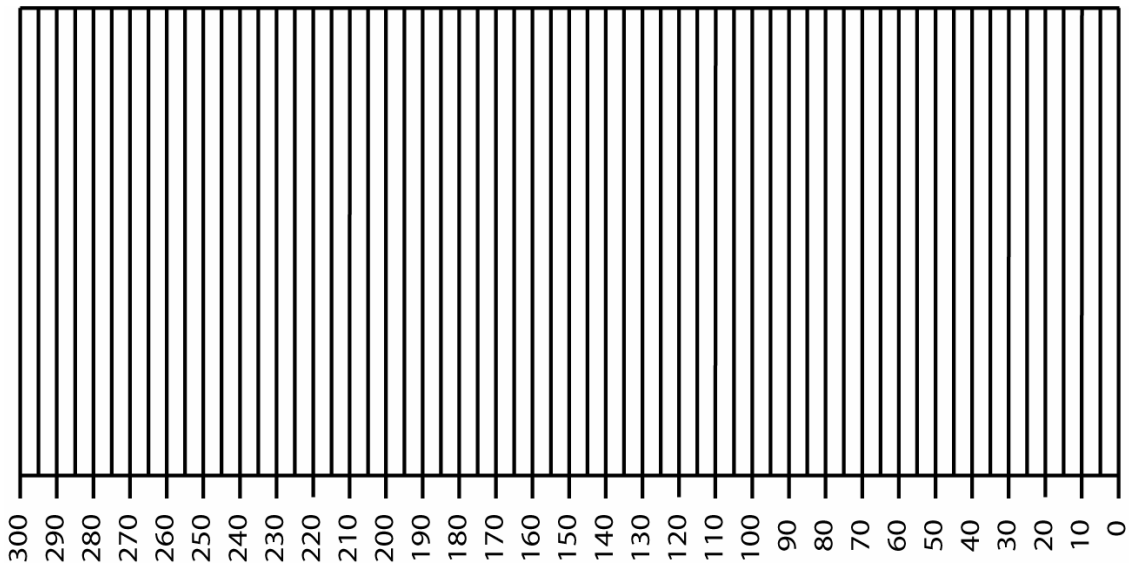
Divide the amount of salt by the total amount. What is the concentration?



Let’s do it again but now with 200 gallons of Solution A and 100 gallons of Solution B.

Shade the salt in the 300-gallon jug to the right. Remember to shade twice as much for Solution A this time since you are adding 200 gallons this time.

Divide the amount of salt by the total amount. What is the concentration?



Isn’t this fun?

Discuss how the final concentration varies as the amounts of each solution vary. Complete the table to help you organize the facts.

Gallons of Solution A	Gallons of Solution B	Final concentration
100	100	
100	200	
200	100	

These next few problems are too large for pictures but use the same reasoning as before. Figure the final concentrations.

Gallons of Solution A	Gallons of Solution B	Final concentration
100	2000 (That's 20 jugs.)	
2000 (That's 20 jugs.)	100	

Estimate upper and lower bounds for the concentration of the final mixture. In other words, there are limits on what the concentration of the final mixture can be. What are those limits? The calculations we have done here will help.

Let's use what we have learned here to solve a typical mixture problem.

We have 40 gallons of a 25% salt solution. How much 80% solution must be added so that the final mixture is 40% solution?

(Let x represent the number of gallons of 80% solution we add. Then figure an expression for the final mixture's concentration using x. Remember the final mixture's concentration will be the amount of pure salt divided by the total amount of stuff (water and salt). Set this expression equal to .40 and solve.)