

Mixture problems: Salt concentration
Guess-and-Check Method

NAME:

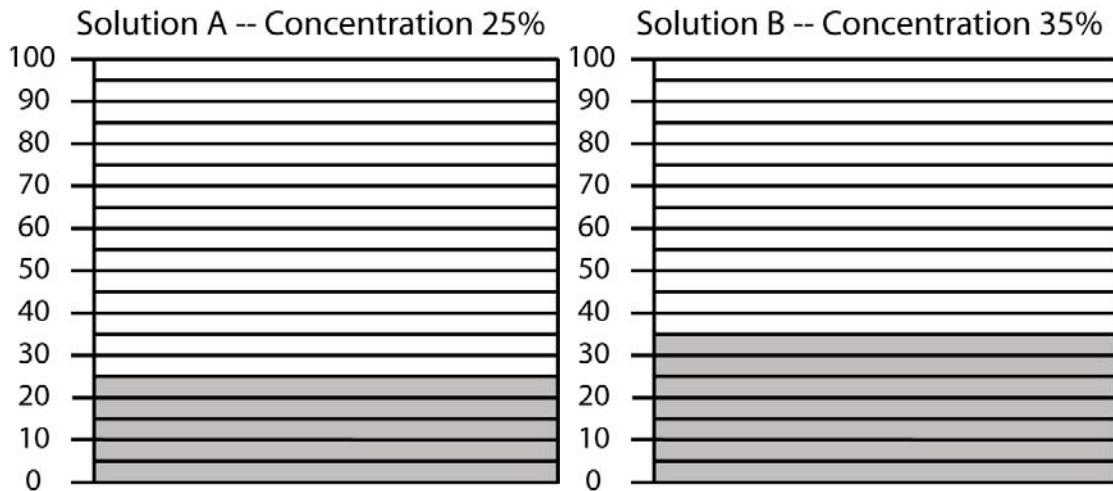
This worksheet will help us understand mixture problems that involve combining liquids of different concentrations to form a final mixture of another concentration.

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.

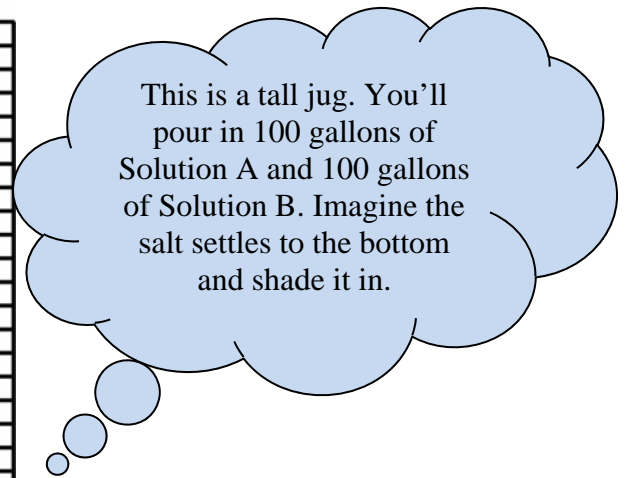
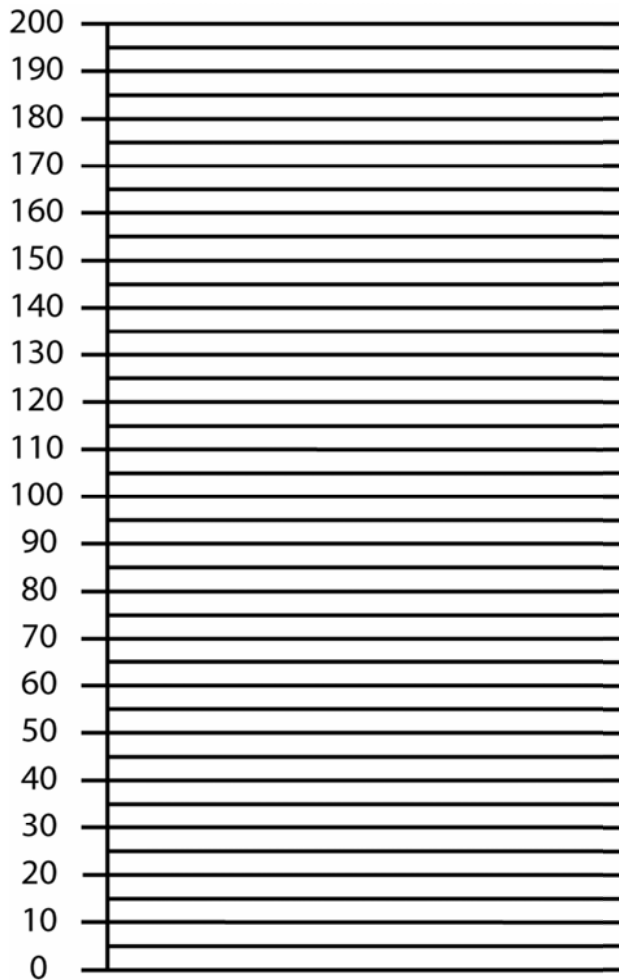
To understand this, I like to picture the salt settling down to the bottom of the jug. The following pictures illustrate two 100-gallon jugs, one with Solution A and one with Solution B. The pure salt has settled to the bottom as the gray material. The white area is pure water.



1. 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).

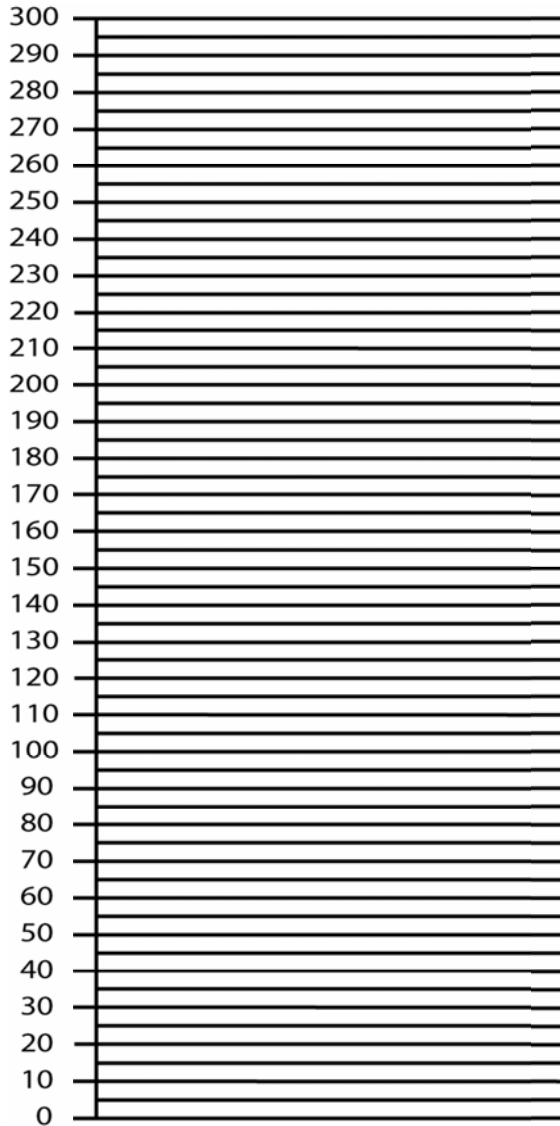


To better understand the relationship between the amounts of each solution we add and the final concentration, we'll play with them a bit.

2. 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?

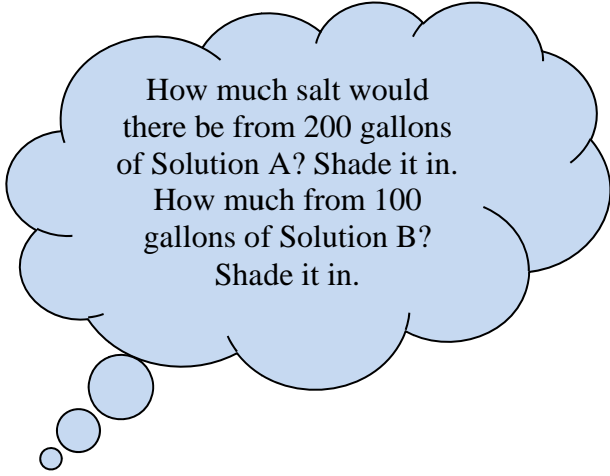
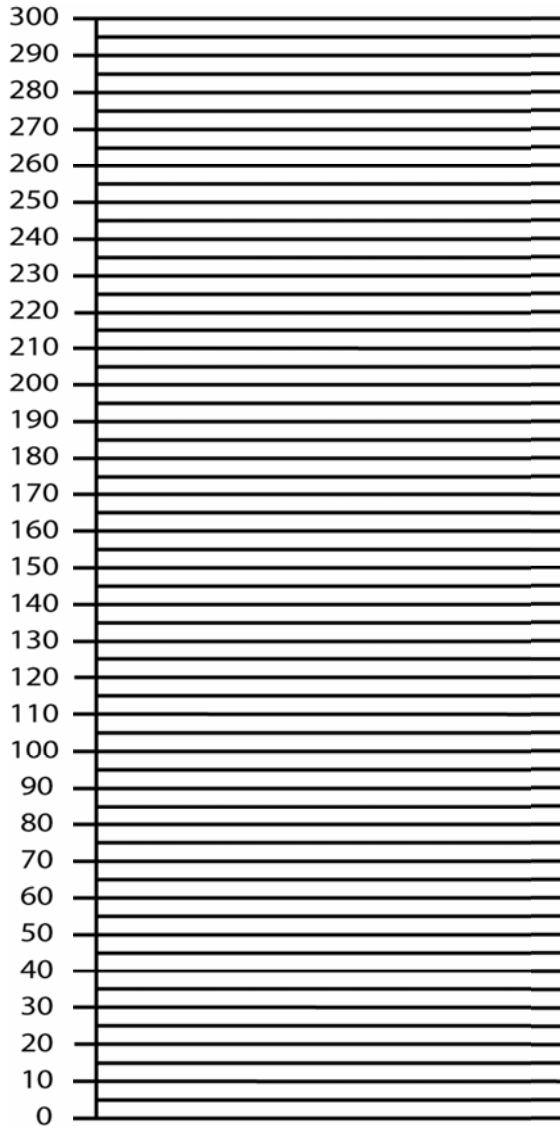


How much salt would there be from 100 gallons of Solution A? Shade it in.
How much from 200 gallons of Solution B? Shade it in.

3. 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?

4. We will next 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 Pure Salt from Soln. A (25% solution)	Gallons of Solution B	Gallons of Pure Salt from Soln. B (35% solution)	Total Gallons of Pure Salt in Final Mixture	Total Gallons of Stuff (Salt and Water) in Final Mixture	Concentration of Final Mixture (Round to the nearest tenth of a percent)
2000 (That's 20 jugs.)		100				
200		100	Copy amounts from question 3:			
100		100	Copy amounts from question 1:			
100		200	Copy amounts from question 2:			
500		1000				
100		2000 (That's 20 jugs.)				

a.) 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? (Hint: Think about the original concentrations.)

b.) You should have had two final concentration values that were the same. Why do you suppose they were the same?

5. 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?

We will attempt this problem by the guess-and-check method. We want to know how much 80% solution to add, so let's start there on our table. What else do we need in our table? I started the table but you'll need to finish it... You may *not* need to use all of the columns. Do not forget a ratings column.

Remember the final mixture's concentration will be the amount of pure salt divided by the total amount of stuff (water and salt). So what other information do you need to find that? What concentration are we trying to achieve?

Gallons of 80% solution added	Gallons of pure salt from 80% solution						

How much 80% solution must be added so that the final mixture is 40% solution? Write answer as a sentence or phrase.