

If you earn a 90% on one test and an 80% on another test, your average is 85%, right? If you earn a 90% on a quiz and a 80% on another quiz, your average is 85%, right? If you get a 90% on a quiz and a 80% on a test, your average is 85%, right? WRONG! Since tests and quizzes are not weighted the same they do not average like normal. The correct average is 83%.

If you mix 12 ounces of orange juice with 12 ounces of water, then the resulting mixture is 50% orange juice and 50% water. However, if you mix 12 ounces of orange juice with 8 ounces of water, the resulting mixture is 60% orange juice and only 40% water.

What we will be investigating in this section is what happens when items are mixed together in unequal ratios. As long as there are equal amount of each, then you may just average the amounts together, like tests with tests and quizzes with quizzes. However when you mix items that have different amounts or values, it is no longer just a simple process.

There are three types of mixture questions: mixing two known amounts, mixing a known amount with an unknown amount, and mixing two unknown amounts to make a known total.

A table is used to help organized the information from the word problem. Amount refers to how much there is of the item. The value refers either to a cost or the percent of acid, juice, etc. The total column is the product of the preceding columns.

$$\text{Amount} \bullet \text{Value} = \text{Total}$$

Example 1: Mixing two known amounts

A chemist mixes 12 L of a 45% acid solution with 8 L of a 70% acid solution. What is the percent of acid in the mixture?

Let x = percent of acid in the mixture

$$20x = 11$$

$$x = 0.55$$

The mixture is 55% acid

	Amount	Value	Total
1 st Solution	12	0.45	5.4
2 nd Solution	8	0.7	5.6
Mixture	20	x	

Example 2: Mixing a known amount with an unknown amount

A 12 ounce juice drink is 15% apple juice. How much apple juice must be added to make the juice drink 25% juice?

Let x = amount of apple juice added

$$0.25(x + 12) = x + 1.8$$

$$0.25x + 3 = x + 1.8$$

$$1.2 = 0.75x$$

$$1.6 = x$$

1.6 ounces of apple juice must be added.

	Amount	Value	Total
Juice drink	12	0.15	1.8
Apple Juice	x	1.00	x
Mixture	$x + 12$	0.25	

Example 3: Mixing two unknown amounts to make a known total

A store sells a mixture of cashews and almonds. The cashews sell for \$4.75/lb and the almonds sell for \$3.50/lb. How many pounds of each should be mixed to make 20 lb of this mix worth \$4.00/lb?

Let x = amount of cashews

$$80 = 4.75x + 3.5(20 - x)$$

$$80 = 4.75x + 70 - 3.5x$$

$$80 = 1.25x + 70$$

$$10 = 1.25x$$

$$8 = x$$

There should be 8 pounds of cashews and 12 pounds of almonds.

	Amount	Value	Total
Cashews	x	4.75	$4.75x$
Almonds	$20 - x$	3.50	$3.5(20 - x)$
Mixture	20	4.00	

Example 4:

A pile of 50 coins has a value of \$6.80. If there are only quarters and dimes, how many are quarters?

Let x = amount of quarters

$$0.1(50 - x) + 0.25x = 6.8$$

$$5 - 0.1x + 0.25x = 6.8$$

$$5 + 0.15x = 6.8$$

$$0.15x = 1.8$$

$$x = 12$$

There are 12 quarters.

	Amount	Value	Total
Dimes	$50 - x$	0.10	$0.1(50 - x)$
Quarters	x	0.25	$0.25x$
Mixture	50	---	6.80

Practice and Applications

For each question: define the variable, write an algebraic equation, solve showing steps, and write the final answer in a complete sentence.

1. 12 ounces of a 30% hydrogen peroxide solution is mixed with 16 ounces of a 3% hydrogen peroxide solution. What percent of the final solution is hydrogen peroxide?
2. A juice maker mixes apple juice and cranberry juice. How much should they charge if they mix 8 L of apple juice selling for \$0.45/L with 10 L of cranberry juice selling for \$1.08/L?
3. A store mixes 15 lb of dried apricots costing \$2/lb with 10 lb of dried apples costing \$1.50/lb. What should be the cost per pound of the mixture?
4. A chemist mixes 16 L of a 40% acid solution and 24 L of a 16% acid solution. What is the percent of acid of the mixture?
5. At the sweet factory, gummy candy is sold for \$3/lb and chocolate candy is sold for \$5/lb. What is the cost per pound of a mixture containing 1.25 pounds of gummy and 0.5 pounds of chocolate?
6. On a recent trip to Las Vegas a family spent 3 hours driving to Las Vegas at 80 mi/hr and 4 hours driving home at 60 mi/hr. What was the average speed?
7. How much water must be added to 64 ounces of grape juice so that the mixture will be 70% juice?
8. A science experiment requires a 10% hydrogen peroxide solution. How much water must be added to 16 ounces of a 30% hydrogen peroxide solution to yield a 10% solution?
9. A science experiment requires a 10% hydrogen peroxide solution. How much water must be added to 16 ounces of hydrogen peroxide to yield a 10% solution?
10. A science experiment requires a 10% hydrogen peroxide solution. How much hydrogen peroxide must be added to 16 ounces of water to yield a 10% solution?
11. A science experiment requires a 10% hydrogen peroxide solution. How much of a 3% hydrogen peroxide solution must be added to 16 ounces of a 30% hydrogen peroxide solution to yield a 10% solution?
12. A science experiment requires a 10% hydrogen peroxide solution. How much of a 30% hydrogen peroxide solution must be added to 16 ounces of a 3% hydrogen peroxide solution to yield a 10% solution?
13. How many milliliters of water must be added to 60 mL of a 15% iodine solution in order to dilute it to a 10% solution?
14. How many liters of water must be evaporated from 10 L of a 40% salt solution to produce a 50% solution?
15. How many liters of water must be evaporated from 20 L of a 3% salt solution to produce a 5% solution?
16. A 200 mL Capri Sun Lemonade is 10% juice. How much pure lemonade must be added to make a drink that is 25% juice?
17. How much of a 30% hydrogen peroxide solution must be mixed with a 3% hydrogen peroxide solution to make 20 ounces of a 5% solution?
18. At the Sweet Factory, gummy candy is sold for \$3 per pound and chocolate candy is sold for \$5 per pound. A two pound mixture of gummy and chocolate candy sold for \$7.60. How much of each type of candy was in the mixture?
19. A manufacturer is making a 16 ounce bottle of a 30% hydrogen peroxide solution. The solution is being made of pure hydrogen peroxide and water. How much of each will be used?
20. A pharmacist mixed some 10%-saline solution with some 15%-saline solution to obtain 100 mL of a 12%-saline solution. How much of the 10%-saline solution did the pharmacist use in the mixture?
21. An 8 kg mixture of cashews and pecans is worth \$7.25/kg. Separately, the cashews sell for \$8/kg and the pecans for \$7/kg. How many kg of each was used to make the mixture?
22. A piggy bank is full of dimes and quarters. The total value of the coins is \$14.05. If there are a total of 100 coins, how many of each does she have?