

Percent and Mixtures

MATH 1441, BCIT

Technical Mathematics for Food Technology

September 25, 2018

The definition of percent is similar to the definition of the word “quarter.” When I say, “three quarters,” I mean $\frac{3}{4}$. When I say “sixty-two percent,” I mean $\frac{62}{100}$. Percent is not a unit—it simply means that the number in question is divided by one hundred. Have a look at the following table.

Percent

0.12	12%
three quarters	75%
0.75	75%
one half	50%
0.5	50%
one and a half	150%
1.3	130%

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 litres of the 15% acid solution. How many litres of 10% solution and 30% solution should you use?

Mixtures

Let x stand for the number of litres of 10% solution, and let y stand for the number of litres of 30% solution. For mixture problems, it is often helpful to create a table:

	litres solution	percent acid	total litres acid
10% solution	x	0.10	$0.10x$
30% solution	y	0.30	$0.30y$
mixture	$x + y = 10$	0.15	$0.15 \cdot 10 = 1.5$

Since $x + y = 10$, then $x = 10 - y$. Using this, we can substitute for x in our grid, and eliminate one of the variables:

	litres solution	percent acid	total litres acid
10% solution	$10 - y$	0.10	$0.10 \cdot (10 - y)$
30% solution	y	0.30	$0.30y$
mixture	$x + y = 10$	0.15	$0.15 \cdot 10 = 1.5$

When the problem is set up like this, you can usually use the last column to write your equation. The litres of acid from the 10% solution, plus the litres of acid in the 30% solution, add up to the litres of acid in the 15% solution. Then:

$$\begin{aligned}0.10 \cdot (10 - y) + 0.30y &= 1.5 \\1 - 0.10y + 0.30y &= 1.5 \\1 + 0.20y &= 1.5 \\0.20y &= 0.5 \\y &= 2.5\end{aligned}\tag{1}$$

Then we need 2.5 litres of the 30% solution, and $x = 10 - y = 10 - 2.5 = 7.5$ litres of the 10% solution. If you think about it, this makes sense. Fifteen percent is closer to 10% than to 30%, so we ought to need more 10% solution in our mix.

Mixture and Percentage Word Problems

Exercise 1: How many litres of a 70% alcohol solution must be added to 50 litres of a 40% alcohol solution to produce a 50% alcohol solution?

Mixture and Percentage Word Problems

Exercise 2: How many ounces of pure water must be added to 50 ounces of a 15% saline solution to make a saline solution that is 10% salt?

Mixture and Percentage Word Problems

Exercise 3: Find the selling price per pound of a coffee mixture made from 8 pounds of coffee that sells for \$9.20 per pound and 12 pounds of coffee that costs \$5.50 per pound.

Mixture and Percentage Word Problems

Exercise 4: How many pounds of lima beans that cost \$0.90 per pound must be mixed with 16 pounds of corn that costs \$0.50 per pound to make a mixture of vegetables that costs \$0.65 per pound?

Mixture and Percentage Word Problems

Exercise 5: Two hundred litres of a punch that contains 35% fruit juice is mixed with 300 litres (L) of another punch. The resulting fruit punch is 20% fruit juice. Find the percent of fruit juice in the 300 litres of punch.

Mixture and Percentage Word Problems

Exercise 6: Ten grams of sugar are added to a 40-g serving of a breakfast cereal that is 30% sugar. What is the percent concentration of sugar in the resulting mixture?

Mixture and Percentage Word Problems

Exercise 7: Your school is holding an event this weekend. Students have been pre-selling tickets to the event; adult tickets are \$5.00, and child tickets (for kids six years old and under) are \$2.50. From past experience, you expect about 13,000 people to attend the event.

This is the first year in which tickets prices have been reduced for the younger children, so you really don't know how many child tickets and how many adult tickets you can expect to sell. You decide to use the information from the pre-sold tickets to estimate the ratio of adults to children, and estimate the expected revenue from this information.

Mixture and Percentage Word Problems

You consult with your student ticket-sellers and discover that they have not been keeping track of how many child tickets they have sold. The tickets are identical, until the ticket-seller punches a hole in the ticket, indicating that it is a child ticket. They don't remember how many holes they have punched. They only know that they have sold 548 tickets for \$2460. How much revenue from each of child and adult tickets can you expect?

Mixture and Percentage Word Problems

Exercise 8: Two different mixtures of gasohol are available, one with 5% alcohol and the other containing 12% alcohol. How many gallons of the 12% mixture must be added to 252 gallons of the 5% mixture to produce a mixture containing 9% alcohol?

Mixture and Percentage Word Problems

Exercise 9: 15 litres of fuel containing 3.2% oil is available for a certain two-cycle engine. This fuel is to be used for another engine requiring a 5.5% oil mixture. How many litres of oil must be added?

Mixture and Percentage Word Problems

Exercise 10: How many litres of a solution containing 18% sulfuric acid and how many litres of another solution containing 25% sulfuric acid must be mixed together to make 552 litres of solution containing 23% sulfuric acid? (All percentages are by volume.)

Mixture and Percentage Word Problems

Exercise 11: How many kilograms of brass containing 63% copper must be melted with 1120kg of brass containing 72% copper to produce a new brass containing 67% copper?

End of Presentation

Next Lesson: Exponential Functions