Percent and Mixtures

MATH 1441, BCIT

Technical Mathematics for Food Technology

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Percent

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

Mixtures

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

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

Mixtures

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

	liters solution	percent acid	total liters 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	$0.15 \cdot 10 = 1.5$

Mixtures

When the problem is set up like this, you can usually use the last column to write your equation. The liters of acid from the 10% solution, plus the liters of acid in the 30% solution, add up to the liters 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 liters of the 30% solution, and $x = 10 - y = 10 - 2.5 = 7.5$ liters 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.

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

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?

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.

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?

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

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?

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.

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?

End of Presentation

Next Lesson: Exponential Functions