

Math Diversion 727

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There is much you have to learn. You must explore; you
must reach out. Go...and give thought to the
the mysteries of the universe.
— The Galaxy Being
(An early proponent of
Life-Long Learning)

The problem is found at:

Source: The Ether of Great Mathematical Ideas
Title: Mixed Rate
Presenter: Patrick

1 Problem

You are in the wilderness when a medical situation arises: A number of persons of your wilderness party have taken cuts and scrapes, requiring immediate first-aid attention. Unfortunately, you do not have enough disinfectant to treat them all. But you have two sources of alcohol available to you in your cabin to make more disinfectant. The literature claims that effective alcohol should be at least 70% to use as a disinfectant.

On hand in the cabin is 0.40 liters of 30% rubbing alcohol and .25 liters of 90% rubbing alcohol. Using these two sources, how much 70% rubbing alcohol can you make?

2 Solution

It's not likely that when we attempt to make as much 70% alcohol as we can, that we will use up both sources in the end. More likely is that we'll use up one of them, leaving some of the other left over. For starters, I'll assume that we'll use up all of the 90% alcohol. (If this assumption doesn't work, we'll try it the other way.) Now let's write down some equations.

To the .25 liters of the 90% alcohol we will add an as-yet unknown amount of 30% alcohol, which we call x . So, the total amount of alcohol we expect to make is $x + 0.25$ liters.

As we combine the two alcohols of different strengths, one thing is certain: In this before-and-after process, the amount of alcohol is conserved. That equation is

$$.30x + .90(0.25[\text{L}]) = .70(x + 0.25[\text{L}]), \quad (1)$$

which has solution for x as

$$x = 0.125[\text{L}]. \quad (2)$$

So, we guessed right.

Anyway, by making this new mixture, we went from having only 0.25 liters of adequate-strength disinfectant to having 0.375 liters.