Math Diversion 938

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Anything worth doing is
worth doing well.
— An Old Saying

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1 The Problem

How many liters of an 8% solution of salt should be added to a 25% solution in order to obtain 510 liters of an 12% solution?

I'm not going to solve this problem because it makes no sense to me. However, problems like this are given routinely for students to solve as though they do make sense. (The reader is encouraged to solved the problem however he or she thinks it should be solved.)

The problem is that a percentage is unitless. Therefore, when taking the ratio of the 'part to the whole' (salt part/whole fluid)$\times$100%, in order to make the fraction unitless, since the whole is given to us in liters, we are forced to interpret the salt as also being in liters. Really? Does this makes sense? I say that for general purposes, it does not. On top of that, there is a limit to how much salt can be dissolved in water.

What if we designate x as the amount in liters of 8% salt solution we need to add to $(520 - x)$ liters of 25% solution to get 510(.25) liters of solution. As an equation we write

$$(.08)(x) + (.25)(510 - x) = (.12)(510)\,, \tag{1}$$

where each term has unit of liters. Crazy! We've just claimed that salt comes in liters.

Now, we *can* do percentages with volumes, but we have to be careful. For example, we can talk about percentages by volumes of alcohol in an alcohol-water mixture. And we can talk about percentages by volumes of oil in an oil-gasoline mixture, say. In fact, mixing oil and gasoline by volumes is probably

the better way to do it for the homeowner making a proper mix for his home gasoline-powered lawn mower. By the way, a US *fluid ounce* is not a weight. It is a volume, being 1/128 th part of a gallon.