Math Diversion Problem 933

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> After a time, you may find that having is not so pleasing a thing after all as wanting. It is not logical, but is often true.
>
> — Spock

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Source: https://www.algebra.com/algebra/homework/word/mixtures/
              Mixture-problems.lesson
Title: Changing a Concentration Problem
  Presenter: Patrick
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1 Problem

How much salt should be added to 1000 milliliters of a 2% salt solution to get a 4% salt solution?

(Concentrations here are mass-to-volume concentrations, measured in [g/mL] units, same as before.) [Assume that the volume of water is not changed by adding this salt.]

2 Solution

Let's make a diagram to help out.

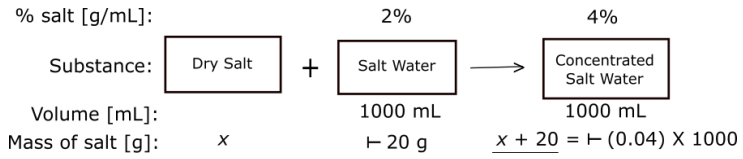

Figure B3. The 2% salt solution has $(0.02\ \mathrm{g}\cdot\mathrm{mL}^{-1})(1000\ \mathrm{mL}) = 20\ \mathrm{g}$ of salt.

1) Conservation of volume is already accounted for.
2) Next, we write down the 'mass conservation of salt' equation:

$$x + 20\,\mathrm{g} = (0.04\,\mathrm{g}\cdot\mathrm{mL}^{-1})(1000\,\mathrm{mL}) = 40\,\mathrm{g}\,. \tag{1}$$

The algebraic solution for x is 20 g.

3 Appendix: How to interpret the diagrams

There are four main types of data in the diagrams I make. The most common are data from given information, and, if chemical, from the coefficients of the balanced equation, and from data tables, such as a periodic table of elements for molar mass information, or nonchemical tables. This kind of data I do not mark up. The second kind of data in diagrams comes from computations based on data in the same column, for which I use the turnstile ($\vdash$) to indicate. The third kind of data is a result in one column that required data from at least one other column to calculate it, and I indicate that kind of value or result by use of the underlining. The fourth kind of data in the figures is the result of combining given information to derive a secondary value. I indicate this kind of data with a right arrowhead ($\blacktriangleright$).