Math Diversion 946

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> It is not enough to be in the right place at the right time. You should also have an open mind at the right time.
> — Paul Erdós

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Source:https://www.algebra.com/algebra/homework/word/mixtures/
                    Advanced-mixture-problems.lesson
Title: A mixed-rate problem
 Presenter: Patrick
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1 The Problem

When weighed in water, tin loses 0.137 of its weight and copper loses 0.112 of its weight. If an alloy of tin and copper weighing 18 pounds loses 2.316 pounds when weighed in water, how many pounds of each are there in the piece [of alloy]?[1]

2 The Solution

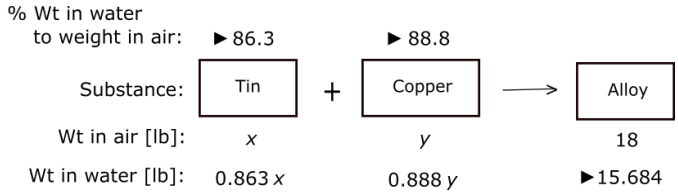

Figure C3. We imagine that the alloy is constructed from its parts.

I will be using some derived quantities in the diagram for this problem, so I should derive them first. So first we have to interpret what the author means

[1] By 'weight' we mean the number we get when using a weighing device. So, the weight of an object can change due to its environment, though the object's mass is invariant. We account for the difference in weights as being due to buoyancy forces of the water on the objects.

by 'tin loses 0.137 of its weight' in water. I interpret it to mean that tin weighs only 86.3% of its weight in air when weighed in water. Likewise, copper weighs only 88.8% of its weight in air when weighed in water. Second, 18 lbs of copper when weighed in air weighs only $(18 - 2.316)$ lbs $= 15.648$ lbs under water.

By conservation of weight in air, we get:

$$x + y = 18\,. \tag{1}$$

By conservation of weight in water, we get:

$$0.863x + 0.888y = 15.68\,. \tag{2}$$

The solution is for x and y is:

$$\begin{aligned} x &= 12.16\,\text{lbs}, \\ y &= 5.84\,\text{lbs}\,. \end{aligned}$$

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 ($\blacktriangleright$).