

Math Diversion 1015

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The greatest killer of creativity is interruption.

— John Cleese

Source: <http://www.beatthemat.com/hard-solutions-mixture-problem-t69704.html>

Title: Mixed-Rate

Presenter: Patrick

1 Problem

Solution Y is 30 percent liquid X and 70 percent water. If 2 kilograms of water evaporate from 8 kilograms of solutions Y and 2 kilograms of solution Y are added to the remaining 6 kilograms of liquid, what percent of this new liquid solution is liquid X?

2 Solution

Without loss of generality, I will assume that we have an 8 Kg sample of liquid Y in an large beaker. I will solve for the answer in two steps. First, I will find the ratio of X to water in the beaker after the evaporation as Step 1. Then for Step 2, I will find the ratio of X to water in the beaker after we add into it 2 more Kg of solution Y. STEP 1: Let P_1 and W_1 be the percentages of X and water, respectively, in the beaker fluid (Y_1) after evaporation.

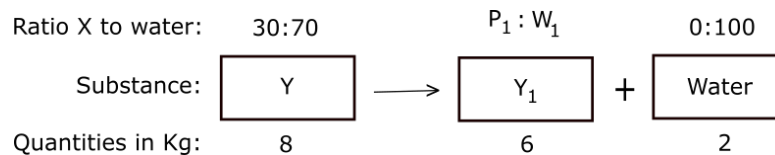


Figure 1. The setup for Step 1.

Time to balance on quantities of X across the process.

$$.30(8) = \frac{P_1}{100}(6), \quad (1)$$

which has solution $P_1 = 40\%$.

STEP 2: Let P_2 and W_2 be the percentages of X and water, respectively, in the beaker fluid (Y_2) after the addition of 2 Kg more fluid Y.

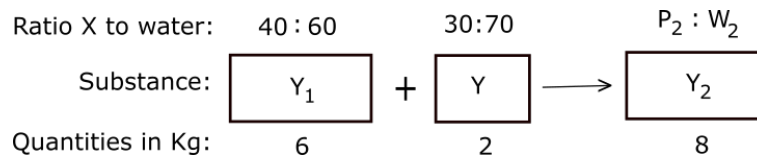


Figure 2. The setup for step 2.

Once again, balance on quantities of X across the process.

$$.40(6) + .30(2) = \frac{P_2}{100}(8), \quad (2)$$

which has solution $P_2 = 37.5\%$.