

Red capsules weigh 5.00 grains (gr). Green capsules weigh 8.00 gr.

For a mixture that is 25.00% red capsules and 75.00% green capsules.

100 capsules = 25 red capsules + 75 green capsules.

1. The total weight is $25 \text{ red} \times \frac{5.00 \text{ gr}}{1 \text{ red}} + 75 \text{ green} \times \frac{8.00 \text{ gr}}{1 \text{ green}} = 125. \text{ gr red} + 600. \text{ gr green} = 725. \text{ gr total}$

2. The average weight = $\frac{\text{total weight}}{\text{no. capsules}} = \frac{725. \text{ gr}}{100 \text{ capsules}} = 7.25 \text{ gr}$

This is called the **weighted average**, because there are more 8 grain tablets, so the average is weighted toward 8 and away from 5.

3. The total capsules can be determined from the total weight only by division by the average weight.

$$? \text{ capsules} = 725. \text{ gr mix} \times \frac{1 \text{ capsule}}{7.25 \text{ gr}} = 100 \text{ capsules (which is correct)}$$

$$\text{Then red capsules can be obtained by } 100 \text{ capsules} \times \frac{25 \text{ red}}{100 \text{ capsules}} = 25 \text{ red}$$

But red capsules cannot be determined from the weight by using $1 \text{ red} = 5.00 \text{ gr}$

$$725. \text{ gr mix} = 725 \text{ gr mix} \times \frac{1 \text{ red}}{5.00 \text{ gr red}} \text{ appears to give } 145 \text{ red which is wrong.}$$

Notice also that **gr mix** and **gr red** do not cancel

Notice also that the average weight of two capsules = $\frac{5.00 \text{ gr red} + 8.00 \text{ gr green}}{2} = 6.50 \text{ gr}$ is not

useful, because $725. \text{ gr} \times \frac{1 \text{ capsule}}{6.50 \text{ gr}} = 111.5 \text{ capsules}$ **Only the weighted average 7.25 is useful.**

4. Also the **weighted average** can be determined directly from the percentages by:

$$5.00 \text{ gr} \times 0.25 + 8.00 \text{ gr} \times 0.75 = 7.25 \text{ gr} \quad [\text{the percentages are converted to fractions.}]$$

5. Then notice also that the **percent abundance is percent by number** not by weight or mass.

$$\text{By weight the red are } \frac{125. \text{ gr red}}{725. \text{ gr total}} \times 100\% = 17.2 \%$$

$$\text{So } ? \text{ red capsules} \neq 725 \text{ gr.} \times \frac{25. \text{ gr red}}{100. \text{ gr mix}} \times \frac{1 \text{ red}}{5.00 \text{ gr red}} = 36.25 \text{ red}$$

is incorrect because $100. \text{ gr total} \neq 25. \text{ gr red} + 75. \text{ gr green}$ [1. above]