**[Performing Dilutions for Laboratory Analysis](https://medlabstudyhall.com/dilutions" \o "Performing Dilutions for Laboratory Analysis)**

**Introduction**

Accurate dilutions are essential to accurate test results. If you dilute something wrong, you will not get the correct result. Incorrect results could harm patients if the physician treats the patients based on those incorrect results.

Before making any dilution always verify your pipettes are clean and in good working order.

**Dilution vs. Ratio**

A dilution is made by combining a certain volume of reagent or specimen with a certain volume of diluent.  The same can be said of a ratio.

The difference is a dilution is expressed as parts reagent or specimen to total parts of solution. A ratio is expressed as parts reagent or specimen to parts diluent. Let’s look at some examples.

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| Reagent | a chemical or biological substance used to detect or measure the amount of a substance. Medical Laboratory Science uses this term specifically for these items used as part of our test kits or analyzers. |
| Specimen | blood, urine, or other body fluid from a human |
| Diluent | a liquid used to lower the concentration of a reagent or specimen to be used with a test kit or analyzer. An example would be saline or deionized water. |
| [Analyte](https://medlabstudyhall.com/glossary/analyte) | the substance being measured by the test kit or analyzer |
| Normal saline | 0.9% saline solution (sodium chloride solution), which is the concentration of saline in the human body. |

**Examples of Standard dilutions**

A standard dilution is a one-time event, mixing the reagent with diluent and using this solution in your analysis.

For example to make a 1:2 dilution mix 1 mL patient sample with 1 mL of deionized water This is written as a 1:2 dilution or a times 2 (x2) dilution. The first number is the volume of reagent (1 mL) and the second number is the total volume of the final solution (2 mL). Expressing a x2 dilution as a *ratio* would be 1:1, or 1 mL

Let’s try another example. A medical laboratory scientist must dilute a specimen times 10 (x10) with normal saline prior to using it for analysis to ensure the [analyte](https://medlabstudyhall.com/glossary/analyte) in the specimen is at the proper ratio to interact with the reagent optimally.  So, this 1:10 dilution is 1 part specimen to 9 parts of diluent, for an end total of 10 parts solution. The ratio is 1:9, or 1 mL specimen and 9 mL normal saline.

As you can see in this example, the volume of specimen is the same in the dilution and ratio, and the volume of saline is the same in both expressions, as well. However, the way they are expressed is slightly different. You just need to understand the difference when explaining them. A 1:10 dilution is not the same as a 1:10 ratio. A 1:10 dilution is the same as a 1:9 ratio.

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| **Term** | **Dilution** | **Volume Reagent or Specimen** | **Volume Diluent** |
| Dilution | 1:9 1:10 | 1 part 1 part | 8 parts 9 parts |
| Ratio | 1:9 1:10 | 1 part 1 part | 9 parts 10 parts |

It is quite simple once you remember that a dilution is expressed in total parts of solution.

Why do we use the expression “dilution” in medical laboratory science more often than “ratio”, when it appears ratio is more logical when calculating how many parts of each substance to use? It’s because of the final calculations needed to determine the final amount of [analyte](https://medlabstudyhall.com/glossary/analyte) in the specimen. If we use a 1:10 dilution, the result you get is multiplied by 10 to get the final result. For example:

The analyzer gives a result of 12 mg/dL on the diluted specimen, but does not do the calculation automatically to account for the dilution. You manually multiply it by 10, so your final cholesterol result is 120 mg/dL.

The dilution (x10) is the same factor you use to calculate the final result (x10).

If we used the equivalent ratio, it would be a 1:9 ratio. You must remember then to adjust your final calculation factor to the total number of parts in the dilution prior to multiplying. You would need to add 1 and 9 to arrive at 10 total parts, then multiply the result by the factor 10 to obtain the final result.

We need to know the total number of parts to use as the factor to determine the final result. It seems best to determine that at the time of dilution rather than after analysis is complete. So, you can arrive at the same information in 2 different ways. The consensus among medical laboratory scientists is to account for it at the beginning of the process instead of the end.

**Conclusion**

Accurate dilutions are critical to accurate test results. Hopefully this has explained the difference between a dilution and ratio as it is used in medical laboratory science.

**For additional information refer to the Procedure: Dilution Protocol (4840-CH-270) which can be found in the General Chemistry Standard Operating Procedure manual.**