Lab Skills Review **Worksheet**

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Lab section: 2A

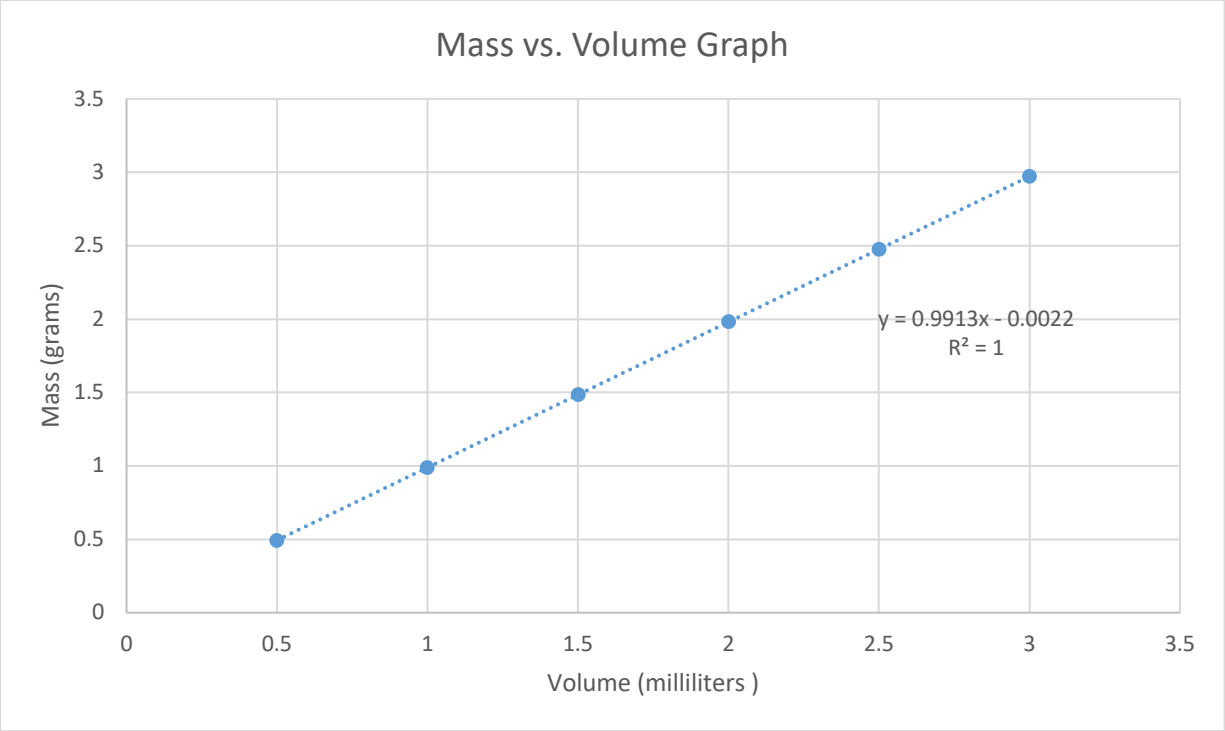
GRADE ____ /20 p

*All work must be **well-written** and **organized**. If you need to collect your thoughts, please use a separate sheet of paper. A major objective of this lab course is to develop skills in scientific communication. Just having the right 'answer' is not good enough – you must communicate **clearly** and **succinctly** and **use terms and concepts correctly**. Please submit the completed document as a PDF to the **Lab Skills Review Worksheet** D2L DropBox folder before the scheduled end of lab.*

1. Volume and Mass Data Table (4 p). Construct a data table of the volume and mass values that you personally collected. That is, for the micropipette volume additions and corresponding masses that you recorded, build a table. The table must be well organized, appropriately titled, have proper column headings, and have the correct sig figs and units for all numerical entries. *In this exercise you are developing skills in organizing and presenting tabular data. This is an important skill for all future lab work*.

Volume (milliliters)	Mass (grams)
0.5	0.492
1	0.99
1.5	1.486
2	1.981
2.5	2.474
3	2.972

2. Determining Density Graphically (4 p). Using EXCEL, prepare a **mass versus volume plot** for the run you performed. Properly title the plot and label the axes correctly. Include the R^2 value and the equation of the linear trend-line (both from EXCEL). The slope of this line is the density of water as determined by you and your technique. Paste in the complete plot below, or if working on hardcopy, *carefully* draw the complete plot below. Remember, use the correct sig figs and units on all values. You will likely need to adjust the sig figs for the R^2 value and the equation of the linear trend-line in EXCEL. *In this activity you are implementing best practices for the presentation of graphical information for this lab course and most scientific communications*.


Mass vs. Volume Graph
Mass (grams)
Volume (milliliters)
y = 0.9913x - 0.0022
R² = 1
0
0.5
1
1.5
2
2.5
3
3.5

3. Analysis of Precision (4 p). *All the following must be in full well-written sentences*. Now consider your mass versus volume plot and R^2 value. What does this say about your **precision**?

My R^2 is exactly 1, and the graph shows a pretty consistent data set with precise and accurate measurements. This should indicate that my precision when measuring the NanoPure water is fairly accurate and there was almost little to no deviation.

4. Percent Relative Error Calculation (4 p). The density of pure water at room temperature (20 °C) is **0.9982 g/mL**. Given this and your result determine the percent relative error. To do this, first symbolically (with mathematical symbols, *not* actual values) state the **equation** used to calculate the percent relative error. Next, give an *example calculation* in which actual values are plugged in and the result shown. Be certain all sig figs and units are correct. *In this exercise you are presenting a calculation in a form appropriate for a scientific document. You are expected to follow this format in all subsequent lab work without being prompted*.

The formula for percent relative error = [(Measured Value – Accepted Value)/Accepted Value] x 100%

For example, for a volume of 1000 milliliters and a measured value of 0.99 grams, the formula would look like the following:
[(0.99 – 0.9982)/0.9982] x 100% = 0%
This would indicate that there was a 0% relative error between the measured value and the accepted value.

5. Analysis of Accuracy (4). *All the following must be in full well-written sentences*. Evaluate the **accuracy** of your micropipette technique. Start by stating the density for water you obtained and the accepted or 'true' value. Next state the calculated percent relative error. What does this say about your **accuracy**?

Based on the results I recorded and the R^2 value on the Mass vs. Volume graph, my micropipette technique appears to be fairly accurate as the percent relative error also indicates a 0% relative error between my measured value and the accepted value given. For example, the accepted value for 1 milliliter is 0.9982 g/mL and my measured value was 0.99 g/mL. Given these pieces of information, it should be concluded that my micropipette skills are fairly accurate.