Chemical Technology Program
General Education & Sciences Division
Cape Fear Community College
Wilmington Campus

Lab Activity: Basics
USE OF VOLUMETRIC PIPETTES

Use of Pipettes (or Pipets)

Chemical Technology Program, Cape Fear Community College

This laboratory experiment is designed to introduce you to an assortment of volumetric pipettes that are commonly found in a laboratory setting. You will use volumetric pipettes throughout the entire two-year program. While some of the procedures may seem trivial and the results obvious, this is a chance for you to develop good laboratory techniques.

Volumetric Pipette

Pipette Bulb

Pipette Pumps

TERMINOLOGY:

Volumetric Pipette: *A piece of laboratory glassware that is a hollow tube allowing liquid to be drawn into one end. They are generally used to measure volumes in the 0.1 to 25.0 mL range. Pipettes may be glass or plastic. Some are disposable (one time use) while others are made for multiple use. General Cost: $15.00 – $75.00 each.*

Pipette Bulb: *Device used to draw liquid into the pipette. Some bulbs also help expel the liquid from the pipette. Bulbs may come in many different forms and shapes.* ***Never use your MOUTH as a pipette bulb.*** *General Cost: $15.00 - $35.00 each.*

Pipette Pumps: *A "semi-automated" way to fill a pipette with liquid. Pumps will come in different sizes for the various pipette capacities. General cost: $35.00 - $55.00 each.*

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Graduated Pipette: *A special type of volumetric pipette that includes a series of lines etched on the glass. These etched lines allow the analyst to add various volume amounts and fractions of a milliliter. General Cost: $25.00 - $35.00 each.*
Serological (Mohr) Pipette: *Pipettes that are graduated but NOT AS ACCURATE as volumetric pipettes. Their use depends on how precise you need to be with your volume measurements. (see Table 16.2 in the handouts for comparison). General Cost: $15.00 to $25.00 each.*

Standard Deviation: *A calculation that informs you how "close your numbers are". If your measurements are close to each other, your standard deviation will be LOW. If your measurements are NOT close to each other, your standard deviation will be HIGH.*

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

Good news! EXCEL will do this for you, so we will use it!

NEVER PIPETTE BY MOUTH

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IN CLASS PROBLEM:
Suppose a technician is verifying the accuracy of a volumetric pipette. The technician delivers 5.00 mLs of water, with a 5.00 mL pipette, a total of six times. She weighs each sample (density of water ~1.00 g per milliliter; therefore, the sample should weigh 5.00 grams).

Weights:	5.0012 g	5.0001 g	4.9997 g
	4.9918 g	5.0103 g	5.0024 g

a. What is the average mass?
b. What is the standard deviation?
c. The volumetric pipette is classified as a "Class A" with a tolerance of +/- 0.01 g or less. Does the analyst "pass" or "fail" on their delivery?
d. Calculate the "error" of the analyst if the actual weight should have been 5.0000 grams.

PART A - USE OF THE VOLUMETRIC PIPETTE
The volumetric pipettes in the lab are probably the most precise, accurate and reliable pieces of glassware that you will use. Although there are inherent limits in the accuracy and precision of these pipettes most delivery errors are caused by incorrect handling of the sample or the pipette. In this experiment you will practice using multiple sizes of volumetric pipettes and minimizing the errors associated with your technique.

GENERAL PROCEDURE FOR USING A VOLUMETRIC PIPETTE
1. Choose the proper pipette size. All sizes will be printed on the outside of the pipette.
2. Examine the pipette to ensure that it is not chipped or broken.
3. Fill the pipette with your liquid using a volumetric pipette bulb. **Overfill it "above the line".**
4. MAKE SURE THAT YOU DO NOT DRAW LIQUID INTO THE PIPETTE BULB!
5. Quickly remove the bulb and use your thumb to control the delivery of the liquid.
6. Allow the extra liquid to drain into a waste container. Ensure that the meniscus is at the proper location (the capacity line).
7. Deliver the contents of the volumetric pipette into the proper container.
8. Our pipettes are "made to deliver" (stamped as TD at the top). Therefore, any residual liquid in the pipette needs to stay. **DO NOT blow out!**

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C-TEACH ACADEMY
BRIDGING HIGH SCHOOL, COLLEGE, AND INDUSTRY

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In this procedure you will deliver various amounts of water into a container using a volumetric pipette. The sample will be weighed. You will then report the weights to the laboratory instructor to ensure that you are properly delivering the correct amount of liquid. Unless instructed otherwise, you should handle the liquid sample with care! Measurements should be made to the nearest 0.1 mg (0.0001 g). **If your balance does not read to FOUR decimal places, please see a laboratory instructor.**

PROCEDURE: Using a 5.00 mL Volumetric Pipette (Class A)

1. Place a weighing bottle on the balance and press TARE. The mass should read "0.0000 g".
2. Using the 5.00 mL volumetric pipette, deliver 5.00 mL of the unknown liquid into the container. Weigh. Record weight on your data sheet.
3. Leave the container (with the volume of liquid) on the balance. Tare the balance again. Add another portion of 5.00 mL into the container and record the new mass. Repeat this process again.
4. You <u>do not</u> need to print off receipt tickets. Make sure that you record your values in the data sheet.
5. The tolerance on a 5.00 mL volumetric pipette should be +/- 0.01. Submit your data to the laboratory instructor to ensure that you are using the volumetric pipette correctly.

PROCEDURE: Using a 10.00 mL Volumetric Pipette (Class A)

6. Repeat the process detailed in the directions for the 5.00 mL delivery, except use a 10.00 mL volumetric pipette instead.
7. The tolerance on a 10.00 mL volumetric pipette should be +/- 0.02. Submit your data to the laboratory instructor to ensure that you are using the volumetric pipette correctly.

PROCEDURE: Using a 25.00 mL Volumetric Pipette (Class A)

8. Repeat the process detailed in the directions for the 5.00 mL delivery, except use a 25.00 mL volumetric pipette instead.
9. The tolerance on a 25.00 mL volumetric pipette should be +/- 0.03. Submit your data to the laboratory instructor to ensure that you are using the volumetric pipette correctly.

PROCEDURE: Using a Graduated Volumetric Pipette (Class A)

10. Repeat the process detailed in the directions for the 5.00 mL delivery, except use a graduated pipette instead. You will need to deliver 0.70 mLs of liquid.
11. The tolerance on a graduated volumetric pipette should be +/- 0.02. Submit your data to the laboratory instructor to ensure that you are using the volumetric pipette correctly.

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IF YOUR DATA "PASSES" YOU HAVE COMPLETED THIS PORTION OF THE PROCEDURE. IF YOUR DATA "FAILS", YOU WILL NEED TO RE-PIPETTE AND CHECK YOUR DATA AGAIN.

PROCEDURE: Test Your Skills!

12. Your instructor will have a 0.150 M solution of copper (II) sulfate pentahydrate [$CuSO_4$ * 5 H_2O] prepared (known as "stock"). Use the table below to make five solutions. The solutions should be prepared in small beakers or other suitable containers (such as a plastic conical tube). Use a pipette for the preparation.
13. Once prepared, the five solutions will be analyzed on a UV-Vis instrument at 635 nm (instructor will aid in this process).
14. Record the absorbance (ABS) values from the instrument. Print off the data report and attached to your laboratory sheet.
15. Submit your data to the laboratory instructor to ensure that you are using the volumetric pipette correctly.

Test Tube	***1***	***2***	***3***	***4***	***5***
Volume of Stock (mL)	10.00	7.50	4.00	2.40	1.00
Volume of Water (mL)	0.00	2.50	6.00	7.60	9.00

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DATA SHEET

Part 1: Using a 5.00 mL Volumetric Pipette

Weight of 1st 5.00 mL addition: ………………………………………………………………………… ________________ g

Weight of 2nd 5.00 mL addition: ………………………………………………………………………… ________________ g

Weight of 3rd 5.00 mL addition: ………………………………………………………………………… ________________ g

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Part 2: Using a 10.00 mL Volumetric Pipette

Weight of 1st 10.00 mL addition: ………………………………………………………………………… ________________ g

Weight of 2nd 10.00 mL addition: ………………………………………………………………………… ________________ g

Weight of 3rd 10.00 mL addition: ………………………………………………………………………… ________________ g

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Part 3: Using a 25.00 mL Volumetric Pipette

Weight of 1st 25.00 mL addition: ………………………………………………………………………… ________________ g

Weight of 2nd 25.00 mL addition: ………………………………………………………………………… ________________ g

Weight of 3rd 25.00 mL addition: ………………………………………………………………………… ________________ g

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Part 4: Using a Graduated Volumetric Pipette

Weight of 1st 0.70 mL addition: ………………………………………………………………………… ________________ g

Weight of 2nd 0.70 mL addition: ………………………………………………………………………… ________________ g

Weight of 3rd 0.70 mL addition: ………………………………………………………………………… ________________ g

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Part 5: Making Solutions Using a Volumetric Pipette: Print off UV Data Sheet or Generate Your Own Calibration Curve Using an Excel Spreadsheet (showing a Linear Regression Equation and Coefficient). Concentration should be plotted on the x axis. Absorbance values should be plotted on the y axis.

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