Protocol 1: Pipette Demonstration and Use

Goal: To determine the variation between different micropipette volumes and liquid types (and learn how to use the most common liquid measurement tools in the laboratory)

During this lab you should learn to:

- Perform basic pipetting with a micropipette
  - Set the tools for a specific volume
  - Operate plunger
- Interpret and follow a scientific protocol
- Perform accuracy and precision analysis

Introduction:

Pipette Use in the Laboratory:

Pipettes are used in the laboratory to aspirate and dispense controlled volumes of liquids. In this lab we will demonstrate the techniques used.

Micropipette:

The pipette is designed to take advantage of pressure differentials to move relatively small volumes of liquids. Unlike the serological pipette, which uses a pump to supply the vacuum, the micropipette uses a moving piston in the body of the device to displace air. The motion of this piston is typically controlled by the user's thumb. The volume is controlled by the distance the piston is allowed to move based on a dial built into the device. The micropipette uses disposable tips that are picked up by the user from a storage box and typically ejected using a built in mechanism.

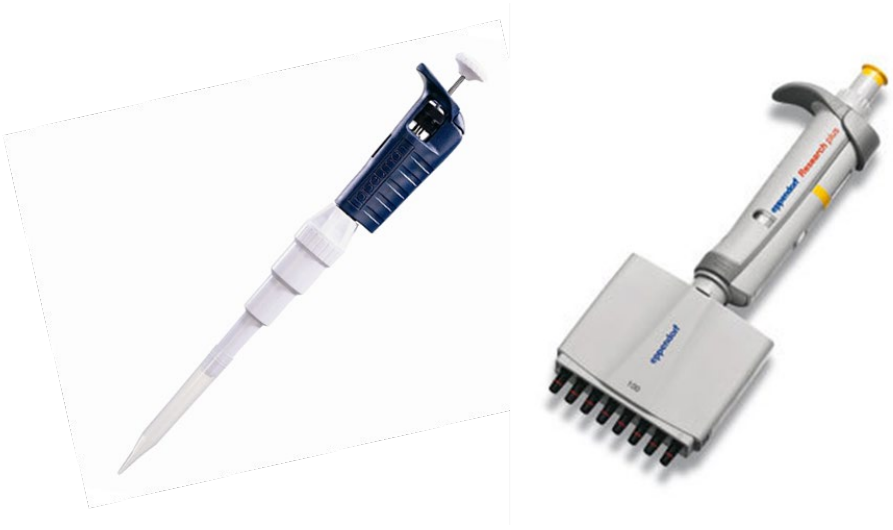

Figure 1: Two micropipettes are shown. The example on the left is a single channel device for dispensing volumes up to 5 mL. The example on the right is a multichannel device for dispensing up to 200 µL in each of eight channels at the same time.

Important Guidelines for using micropipette:

1. Be aware of the range for the micropipette and **do not** set the volume outside of this range. If your chosen tool does not operate in the desired range, you need to find a different tool.
2. Always use a pipette tip and never use the pipette directly in the liquid.
3. Do not pull liquid up above the pipette tip.
4. Try to avoid bubbles in the tips.

Consider these questions while completing the lab.

What parts of your technique lead to errors in measurement?

Which fluid was most viscous? What changes to technique need to be made to account for viscosity of the fluids?

Which volume was dispensed most precisely? Most accurately?

Protocol:

Materials needed:

Plastic Weigh boats	20% Glycerol + water
Balance	200 µL pipette tips
Micropipette set	Paper towels
Water	500 mL beaker

Step-by-step Instructions:

Prior to doing any lab work, please clean your station by wiping everything in your area down with Lysol wipes and ethanol. Prior to starting on the protocol below, feel free to practice dispensing different volumes of liquid into a weight boat. You could even make pointillism art. Practice each volume until you are able to generate droplets of consistent size.

1. Refer to the data table below. Under the volume column choose whatever volume of each liquid you would prefer in the given ranges. For that volume, estimate the expected weight of that volume of liquid. **You may need to use a lab calculator or pen and paper, but do not use your cell phone calculator!**
   - 25% Glycerol + water (Density: 1047 mg/mL)
   - Water (Density 998.2 mg/mL)
2. Add a weigh boat to the scale
3. (Zero) Tare the balance
4. Dispense liquid of the target volume into the weigh boat. Be careful not to get any liquid outside the weigh boat!

5. Record the weight registered by the balance. (If this weight is more than 20% off from the expected weight, check your technique for issues. If you continue to have problems, check your technique with a TA or your instructor.)
6. For the next trial of liquid measurement, go back to step 3. Repeat steps 3 – 5 until each liquid-volume pair has been weighed and recorded 4 times.
7. Remove weigh boat from the balance and dump the liquid into the 500 mL liquid waste beaker.
8. When you have finished working with a liquid, discard the pipette tip into the waste beaker.
9. Complete the analysis of your data and show the results to your instructor or TA. If there are issues, discuss them and rerun the protocol.

Data Table (attempt 1)

Liquid	Volume (µL)	Expected Weight (mg)	Trial 1 Weight	Trial 2 Weight	Trial 3 Weight	Trial 4 Weight	Average Weight (mg)	Average Error (%)	Range (mg)	100 * Range / Expected Weight (%)
							Accuracy: How close to the target did we get?		**Precision: How much variation did we have from trial to trial?**	
25% Glycerol	You Pick (1-10 µL)									
25% Glycerol	You Pick (200-1000 µL)									
Water	You Pick (1-10 µL)									
Water	You Pick (200-1000 µL)									

Notes and Observations:

Data Table (attempt 2 if necessary)

Liquid	Volume (µL)	Expected Weight (mg)	Trial 1 Weight	Trial 2 Weight	Trial 3 Weight	Trial 4 Weight	Average Weight (mg)	Average Error (%)	Range (mg)	100 * Range / Expected Weight (%)
							Accuracy: How close to the target did we get?		**Precision: How much variation did we have from trial to trial?**	
25% Glycerol	You Pick (1-10 µL)									
25% Glycerol	You Pick (200-1000 µL)									
Water	You Pick (1-10 µL)									
Water	You Pick (200-1000 µL)									

Notes and Observations:

Data Table (attempt 3 if necessary)

Liquid	Volume (µL)	Expected Weight (mg)	Trial 1 Weight	Trial 2 Weight	Trial 3 Weight	Trial 4 Weight	Average Weight (mg)	Average Error (%)	Range (mg)	100 * Range / Expected Weight (%)
							Accuracy: How close to the target did we get?		**Precision: How much variation did we have from trial to trial?**	
25% Glycerol	You Pick (1-10 µL)									
25% Glycerol	You Pick (200-1000 µL)									
Water	You Pick (1-10 µL)									
Water	You Pick (200-1000 µL)									

Notes and Observations: