Open the stopcock of the buret and allow the distilled water to run from the buret into a beaker or flask. Examine the buret while the water is running from it. If the buret is clean enough for use, water will flow in sheets down the inside surface of the buret without beading up anywhere. If the buret is not clean, repeat the scrubbing with soap and water.

Once the buret is clean, refill it with distilled water to a point somewhat below the zero mark. Determine the precise liquid level in the buret to the nearest 0.02 mL.

With a paper towel, clean and wipe dry a 150-mL beaker. Weigh the beaker to the nearest milligram (0.001 gram).

Place the weighed beaker beneath the stopcock of the buret. Open the stopcock of the buret and run water into the beaker until approximately 25 mL of water has been dispensed. Determine the precise liquid level in the buret to the nearest 0.02 mL. Calculate the volume of water that has been dispensed from the buret by subtraction of the two liquid levels.

Reweigh the beaker containing the water dispensed from the buret to the nearest milligram, and determine the mass of water transferred to the beaker from the buret.

Use the Density of Water table from Appendix H to calculate the volume of water transferred from the mass of the water. Compare the volume of water transferred (as determined by reading the buret) with the calculated volume of water (from the mass determinations). If there is any significant difference between the two volumes, you probably need additional practice in the operation and reading of the buret.

How does the volume dispensed by the buret compare to the volumes as determined in Part A using a graduated cylinder or beaker? How does the volume dispensed by the buret compare to that dispensed using a pipet in Part B?

Which measuring device (beaker graduations, graduated cylinder, pipet, buret) gives the greatest precision?

Calculations

In several places in the experiment, you are asked to use the table in Appendix H which lists the density of water at various temperatures, so that you can compare the *volume as delivered* by the pipet or buret, with the *volume calculated from the mass of water transferred.* Since the determination of mass is typically more precise than the determination of volume, this serves as a check on the calibration marks on the pipet or buret, and also on your skill in using them.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\text{volume} = \frac{\text{mass}}{\text{density}}$$

Suppose we measure the mass of a "5 mL" sample of water at 22°C and find that it weighs 5.015 g. Using the density of water at 22°C from Appendix H (0.99780 g/mL), the calculated volume of the sample of water would be given by

$$\text{volume} = \frac{\text{mass}}{\text{density}} = \frac{5.015\,\text{g}}{0.99780\,\text{g/mL}} = 5.026\ \text{mL}$$