Obtain a 5.00 mL volumetric pipet. This pipet has a precision of 0.01 mL when it drains completely in a vertical position with its tip in contact with glass; **the last drop is not blown out**. You should practice pipetting until you feel reasonably comfortable with the technique. **Note that you should never pipet with your mouth; everything you will ever pipet in this class will be poisonous.**

Since the volumetric pipet has a precision of 0.01 mL, the volumes measured will vary between 4.99-5.01 mL. What do you think the 'spread' of masses will look like?

Again, repeat the experiment (weigh a capped vial, add 5.00 mL water), reweigh, and repeat three times. Calculate the density of the water from each trial.

Calculations

1. Calculate the density of the water obtained from each trial using each piece of volumetric glassware. Average the densities and report the average density for each piece of glassware.

2. Calculate and report the standard deviation of the average density for each piece of glassware. The standard deviation s is calculated according to eq 1.

$$s = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - \bar{x})^2} \qquad (1)$$

In eq 1, N is the number of points in the data set (N = 3 in all cases here). The x_i are the individual calculated densities for each type of glassware, and the $\bar{x}$ are the average densities for each type of glassware. Report your result for each type of glassware in table form as shown in eq 2.

Average density ± standard deviation (2)

(To get the ± sign in Word, pull down the Insert menu and go to Symbol. Hunt around until you find the symbol you want, click on it, and click Insert.) **Your instructor will demonstrate how to calculate the mean and the standard deviation using Excel.**

3. **Which piece of glassware resulted in the largest standard deviation? Discuss the significance of this in the discussion section of your lab report.** Calculate the percent relative error for the average densities obtained from the various pieces of glassware versus a known value of 0.998 g/mL Percent relative error (PRE) is given by eq 3

$$PRE = \left| \frac{D_{exp} - D_{true}}{D_{true}} \right| x\ 100 \qquad (3)$$