

Chemistry 123

THE VOLUMETRIC PIPET EXERCISE

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INTRODUCTION

The purpose of this exercise is to determine the *precision* and *accuracy* of your 10-mL volumetric pipet and to practice good analytical laboratory skills. The exercise to be completed involves weighing water delivered by your pipet into a series of vials. The weight of the water is then converted into volumes, using the reciprocal density of water at the delivered water's temperature. This method is commonly used to verify the calibration of volumetric glassware and is often required for reliable analytical work. **Note:** It is useful to do your calculations in lab, as data is acquired. This will help spot technique problems and can ultimately save time.

EXPERIMENTAL PROCEDURE – to be done individually

1. Fill a large beaker with DI water and allow it to equilibrate to room temperature.
2. Clean your 10-mL volumetric pipet by half filling with a mild (diluted) detergent solution, shaking, and rinsing well. A uniform water film should remain on draining. Continue cleaning if droplets appear. If droplets persist, see your laboratory instructor.
3. Obtain and weigh three *capped and labeled* snap-cap vials using an analytical balance. Record the weight of each vial in your notebook. Since you will be weighing by difference, the vials do not need to be dried inside. Be sure that the outsides and the caps are dry however, to avoid any water loss and resulting weight change in handling. Remember to handle the vials with a KimWipe to avoid leaving fingerprints.
4. Record the temperature of the beaker of water to the nearest degree before each pipetting. Use a pipet pump or bulb to draw water above the pipet's calibration mark. **Note:** If you use a pipet pump, you must remove the pump after drawing water above the calibration mark. Wipe away any outside water on the tip with a KimWipe. Adjust the level downward so that the meniscus bottom coincides with the pipet's calibration mark and touch the tip against a beaker to catch the hanging drop. Drain the pipet into a weighed vial being careful to avoid spattering. Wait 15 to 30 seconds after apparent drainage has stopped and touch the pipet tip to the inner surface of the vial, catching the hanging drop. Do not force further drainage. Repeat this process with the two remaining vials and again weigh the vials.
5. Calculate the volume delivered for each trial by multiplying the weight of the water delivered by the appropriate reciprocal density (Table I). Calculate the mean, standard deviation, and relative standard deviation (ppt) for the set of volumes delivered. Calculate the relative error (ppt) of your pipet assuming that 10.00 mL should be delivered. Be very careful to follow significant figure rules for all calculations, which include rounding **s**, **rsd**, and relative error to 2 significant figures. You will be graded on the precision and accuracy of the set of volumes delivered as well as the calculations and significant figures. Record this experiment in your lab notebook, complete the Data and Results Summary sheet, and turn it in to your instructor when due.

Table I. Reciprocal Density of H₂O

Temp (°C)	Reciprocal H ₂ O Density (mL/g)
18	1.0025
19	1.0026
20	1.0028
21	1.0030
22	1.0032
23	1.0034
24	1.0036
25	1.0040
26	1.0042
27	1.0045
28	1.0047
29	1.0050
30	1.0053