Experiment 1: Use of Common Lab Equipment, and Determining Significant Figures in Equipment

Please read the background handout for this lab BEFORE you start the lab

Procedure

Safety Precautions:

- All of the materials for this experiment are harmless.

Waste Disposal:

- There is no waste for this experiment. Sodium chloride can be put down the sink with lots of water.

Note: Ideally, we would want to do the following measurements three times to reduce the risk of making a measurement error. These are operator errors. Mistakes can go unnoticed when we base experimental conclusions on one measurement. Due to time constraints in lab, we might not make multiple measurements for each part. Bear in mind that this adds to the error in your data.

BEFORE YOU BEGIN THE LAB, COLLECT YOUR WATER FOR PART II.

Collect about 100 mL of distilled water in a beaker. Let it sit on the counter while you perform Part I. After you are finished with Part I, take the temperature of this water.

Part Ia: Mass Measurement-Centigram Balance

(1) Look carefully at the balance. What is the uncertainty of the balance you are going to use?

(2) Obtain a metal slug (a piece of metal) from under the hood. Record all measurements to the correct number of significant figures.

(3) Obtain the mass of a metal slug on a centigram balance using the direct weighing method

(4) Tare the balance. Record the mass of the metal slug.

(5) Obtain the mass the same metal slug by difference, or traditional method.

(6) First, determine the mass of the weigh paper or container. Then place the metal slug on the paper and determine the combined mass. Determine the mass of the slug by difference.

Part Ib: Mass Measurement-Analytical Balance

(1) Look carefully at the balance. What is the uncertainty of the balance that you are going to use? Record all measurements to the correct number of significant figures.

(2) Determine the mass of the **same slug** used in PART Ia on an analytical balance by the direct method. Record the mass using the number of figures justified by the sensitivity of the balance you used.

(3) Repeat the measurement of the mass of the slug, this time using the traditional (by difference) method. Remember to close the glass doors each time you use the balance.

Part Ic: Measuring the Mass of Chemicals using the direct method

(1) Record all measurements to the correct number of significant figures.

(2) Weigh an empty 50 or 100 mL beaker or a piece of weighing paper on a centigram balance.

(3) Tare the balance.

(4) Add a small amount (1 -2 g) of sodium chloride or sand to the beaker. Record the mass of the salt to the correct number of significant figures.

Part IIa: Make a Meniscus Reader

(1) Make a burette reader by gluing a piece of colored or black paper to an index card. Keep this card in your drawer for future use. These are handy for reading graduated cylinders too! You will be marked down on future labs if this is not in your drawer ready to be used.

(2) Hopefully, you collected your water so you can begin Part IIb. If not, do it NOW!

Part IIb: Volume Measurement-graduated cylinder and density

(1) Take the temperature of your water sample

(2) Go to the CRC and look up the density of water at the temperature of the water

(3) Obtain a 25-mL graduated cylinder from your desk. Make sure it is clean and dry. You are going to determine the uncertainty for the measurements in this graduated cylinder.
(4) Look at the cylinder. What are the major marks? How many places after the decimal point should you represent?
(5) Weigh the **empty** cylinder on a centigram balance and record the mass. Use the same balance for all mass measurements.
(6) You will collect 5 samples of the water collected in Part IIa. It is really important to get the temperature of this water!
(7) **SAMPLE 1:** Carefully, add some of your distilled water sample to the graduated cylinder until, in your judgment, it contains about 5.0-mL of water. Record this volume to the correct significant figures**.** **This is the volume of sample 1.** Use V_1 for this reading
(8) Looking at the meniscus, position your eye so that it is above the meniscus. Record this volume. (V_{above}). Looking at the meniscus, position your eye so that it is below the meniscus. Record this volume. (V_{below}).
(9) Weigh the cylinder and contained water and record the mass. **This will be used to calculate the density of sample 1.** Use M^*_1 for this reading.
(10) **SAMPLE 2:** Without emptying the cylinder, add a second carefully measured 5.0-mL sample of the distilled water to your graduated cylinder.
(11) Read the total volume with the correct significant figures. It represents the volume of Sample 1 and Sample 2.[V_{1+2}]
(12) Weigh the cylinder and contained water and record the mass. [M_{1+2}] You will use subtraction to obtain the mass of sample 2. You will use this mass to calculate the density of sample 2.

Part III: Volume Measurement-burette.

Obtain a 50-mL burette and a 50 or 100 mL beaker from the hood, a burette clamp from the common equipment drawer, and a ring stand.

(1) Look at the burette. What are the major marks? How many places after the decimal point should you represent?
(2) Fill the burette past the 0.00-mL mark with some of the distilled water that you had collected earlier in the experiment.
(3) Play with the stopcock and release enough water such that the meniscus sits at the 0.00-mL mark.
(4) Carefully open the stopcock and allow water to drain into the beaker until you have DELIVERED about 10-15 mL.
(5) Read the final volume
(6) Repeat steps 4 and 5 two more times, recording the initial volume and final volumes each time.

Part IV: Temperature Calibration and Thermometer use-thermometer check

(1) Obtain three thermometers, you will find them under the hood.
(2) **If possible**, note the manufacturer, serial number and manufacture date of the thermometer.
(3) Note the temperature range of the thermometer.
(4) Note the precision of the thermometer. (What is the "uncertain" digit to which readings can be made?)
(5) Check to make sure that the liquid in the stem of the thermometer has not separated. If it has, ask your laboratory instructor for a new thermometer.
(6) With white tape, label the three thermometers.

Part IVa: Temperature Calibration and Thermometer Use-Calibration at the boiling point of water

(1) Set up a hot plate with a 250 mL beaker resting on it.
(2) Fill the beaker about half full with distilled Water. Add few boiling chips (if available) to promote smooth boiling.
(3) Examine the thermometer and determine the precision based on the same technique used in parts I, II, III, and IV

(4) Clamp the thermometer to the ring stand as before such that the bulb is centered in the water in the flask.
(5) Turn on the hot plate and allow the water to come to a boil.
(6) Allow the temperature shown by the thermometer to stabilize
(7) Make sure that the bottom of the thermometer doesn't touch the bottom of the beaker because this could cause the thermometer to be inaccurate.
(8) After 1 minute at the stable temperature, record the temperature to the correct precision.
(9) The Boiling Point of Water is extremely sensitive to the atmospheric pressure. Note the atmospheric pressure from the board in your report sheet
(10) Use the data in the Appendix or the CRC to determine the correct Boiling Point of Water. What is the Percentage Error in your measurement?

Part IVb: Temperature Calibration and Thermometer Use-Calibration at the freezing point of water

(1) While you are waiting for the water to boil in Part IVa, place ice in your other beaker.
(2) Fill the beaker about half full with distilled Water.
(3) You want a good amount of water and ice cubes in there so that the thermometer is accurate.
(4) Thoroughly stir the Ice-Water mixture.
(5) Wait until the alcohol in the thermometer has stopped dropping and is at a steady level (this is called thermal equilibrium), and then mark with the marker where the alcohol is at. This mark indicates 0°C or the freezing point of water.
(6) Make sure that the bottom of the thermometer doesn't touch the bottom of the beaker because this could cause the thermometer to be inaccurate.
(7) Allow the temperature shown by the thermometer to stabilize. After 1 minute at the stable temperature, record the temperature to the correct precision. .
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