Precision, Accuracy, and Density Lab

Pre-Lab Questions:

1. What units of measure will we use for the volume of water?
2. How do you decide how many digits to have in a measurement? (ie – 34 vs. 34.019)
3. What is precision and accuracy?

Objectives:

- To learn to use a laboratory balance and graduated cylinder.
- Discover a relationship between mass and volume.
- Analyze measurements for significant figures, accuracy, and precision.

Procedure:

Part A: Accuracy and the Graduated Cylinder.

1. Find the mass of a dry 10 mL beaker. Record this in the data table for Part A.
2. Fill a 10 mL, 25 mL, 50 L, and 100 mL graduated cylinder to capacity with tap water (ie- the 10 mL cylinder should have exactly 10.0 mL of water)
   Use a pipette to add or remove water to get as *accurate* a reading as possibly.
3. With the pipette, move 5 mL from the 100 mL graduated cylinder into the dry beaker.
4. Weigh the beaker and record this number as *accurately* as possible in the "beaker + water column".
5. **Do not empty the beaker.** Remove the beaker from the balance for step 6.
6. Record the "mass of beaker + water" as the "mass of beaker" for the second line of the table.
7. With the pipette, move 5 mL from the 50 mL graduated cylinder into the beaker.
8. Record this weight as the "beaker + water" for the second line of your table.
9. Continue this method for the 25 mL and 10 mL graduated cylinders.
   Do not empty the beaker until you have all of the information needed for your data table.
10. Determine the mass of water for each incremental addition to the beaker.

Part B: The Density of a Metal

1. Add about 10 mL of water to the 25 mL graduated cylinder. Record this volume in the data table for part B.
2. Measure and record the mass of the cylinder and water as *accurately* as possible.
3. Add enough dry aluminum pellets so that the water level rises at least 5 mL.
4. Record the new water level in the table. Be sure to read the cylinder as *accurately* as possible.
5. Determine the mass of the cylinder, water, and aluminum. Record this new mass in your table.
6. Calculate the mass and volume of the aluminum sample and fill these values into your table.

Questions: Answer these in complete sentences in your notebook. When doing math be sure to show all work and use significant figure rules for rounding your final answer.

Part A:

1. How should the mass of water in each trial compare?
2. Looking at your data, was the data accurate? Was it precise? Explain.
3. Looking at the whole class data, was the data accurate? Was it precise? Explain.
4. Using the accepted density of water (1.0 g/mL), calculate the ideal mass of 10.0 mL of water. Which cylinder was most accurate?

Part B:

5. Calculate the percent error of using the equation below. The accepted density of aluminum is 2.70 g/mL.

$$\% \text{ error} = \frac{\left| \text{Accepted} - \text{Measured} \right|}{\text{Accepted}} \times 100$$

6. Was your data accurate? Was it precise? Explain.
7. Why would this method for finding density not work to find the density of sugar or salt?

Part A:

Starting volume of water	_____	mL
Final volume of water	_____	mL
Mass of cylinder + water	_____	g
Mass of cylinder, water, and Al	_____	g
Volume of Al	_____	mL
Mass of Al	_____	g
Measured density of Al	_____	g/mL
Accepted density of Al	_____	g/mL
Percent error	_____	%

Part B:

Graduated Cylinder	**Beaker Mass** (B)	**Beaker + Water Mass** (A)	**Water Mass** (A-B) = C	**Observed Volume**	**Deviation** (Expected – Observed)
1000 mL					
50 mL					
25 mL					
10 mL					