Measurements/Significant figure/Density Lab

Purpose: **To increase the accuracy and precision in measurements.**

Background:

In science we work with measurements which are different than working with numbers in math. In science our measurements can be no more accurate than the measuring tool that is being used. All measurements should follow the same rule –'record all known digits on the measuring device and add one estimated figure'. If everyone is following the same rule, all measurements will be precise. Every known digit and estimated digit in a measurement is called a significant figure. You can only increase the number of significant figures in a measurement by using a more accurate measuring tool. Finally all measurements must include a unit to signify what is being measured.

Materials:

Biuret stand	**Biruet**	**400 ml beaker**	**thermometer**	**overflow can**
Cube sample of aluminum		**100ml graduated cylinder**		**10 ml grad. Cylinder**
Balance (varying decimals)		**ruler**	**pipet**	**Al cube**

Part I Practice: - Use the correct measuring rule when measuring the following

1. **Using a biuret measure the volume of water already in the biuret. Record the value _____.**
2. **Using a thermometer measure the temperature of the water in the large beaker. Record the value _____.**
3. **In the 100 ml beaker measure the volume of water already in the graduated cylinder. Record the value _____.**
4. **Using a large beaker record the volume of the water already in the beaker. Record this value _____ Now add 3 drops of water to the beaker using a pipet. Re-measure the volume of water in the beaker. Record the value _____.**
5. **Measure the volume of water in the 10 ml graduated cylinder record the value _____. Now add 3 drops of water to the 10 ml graduated cylinder using a pipet. Re-measure the volume of water in the 10 ml graduated cylinder. Record the value _____.**

Questions:

1. **Does the volume in the 100ml graduated cylinder, large beaker, biuret, and 10 ml graduated cylinder all have the same number of decimal places _____. Why not?**
   _____
2. **Why should you never use a beaker to measure the volume of a liquid in a lab?**
   _____
3. **What is the number of significant digits in the beaker _____, in the 10 ml graduated cylinder _____, in the 100 ml graduated cylinder, _____, in the biuret _____.**
4. **After adding 3 drops of water to the beaker did the volume change? _____ Were you able to measure this? _____. After adding 3 drops of water to the 10 ml graduated cylinder did the volume change? _____ Were you able to measure this change? _____. Explain why this happened? _____**
   _____

Part II Finding the Density of Aluminum

1. **Find the length of one side of the aluminum cube in cm. Record your value _____**
2. **Volume is L*w*H. Since the sides of the cube are all the same find the volume of the cube by cubing your length measurement. Note - your calculation cannot have more significant digits than the least in your measurement. Record the value _____. What is your unit of your calculation _____. Cm^3 is the definition of a ml. What is the volume of your cube in ml. Record this number _____.**
3. **Find the volume of water using water displacement. Fill the overflow can full of water. Let the excess run out the spout. Gently place the cube of Al in the overflow can and collect the volume of water in an empty 100 ml graduated cylinder. Record the volume of water collected _____.**
4. **Dry the aluminum and place it on the electronic balance. Record the value _____. Note that you would not estimate a digit on an electronic devise. The last digit is already estimated for you.**

Questions:

1. **Density is defined as M/V.**
   a. **Calculate the Density of the cube from your mass and volume using the ruler. Show work below.**

   b. **Calculate the Density of the cube from your mass and volume using water displacement. Show your work below.**

2. **Your calculated answer cannot have more significant figures than you least accurate measurement. What is the density from 1a _____. What is the density from 1b _____.**
3. **Are the two numbers the same _____ why/why not?**
   _____
4. **Do the two numbers have the same number of significant figures _____. Why/why not?**
   _____
5. **Other groups in the class had different balances. Talk to these groups. What are their values for density _____ and _____. If all 3 values are "correct" why does their values have different numbers of significant figures?**
   _____
6. **In measurements how do you increase the number of significant digits?**
   _____
7. **Record the measurements of the other groups that had the same balance type as you _____. What is the average value _____. How precise were these measurements? _____. Why _____**
8. **The known density of Aluminum is 2.7 g/ml. Percent error is l actual – theoretical l / theoretical. Calculate the percent error. Show work below. Comment on the accuracy of your groups measurements.**