Laboratory Assignment for Handout 4-Results Statements and Error Analysis.

At this point, you have finished **Experiment 2** and have read **Handout 4, How to write an evaluation**. Base on the information in the handout, you should be able to evaluate the following error statements.

The statement should describe what was accomplish in the lab (the purpose), what your results were (final data calculations, for example), observations, and conclusions, and sources of error and how they might affect the results. Use the Pre-lab sheet for the lab as a guide. There is good information.

Did the student:

1 Re-stated the purpose and how the lab addressed the purpose,
2 Sumerize the observations,
3 Summerize the results,
4 Draw conclusions based on the results.
5 Address the concepts or questions presented in the prelab handout,
6 Sumerize the concepts learned in the lab, and made conclusions supported by the data and knowledge gained from the class or outside reading,
7 Demonstrate in the course of writing the evaluation, that s/he has a keen grasp ofthe concepts presented in the lab and a full understanding of the material.
8 Was the result summary was easy to read;
9 Did it use good grammar, good spelling, Standard English, and a logical flow of ideas?
10 Were complete sentences used? (Short well-worded sentences are better than long, poorly, worded sentences.)

100% Everything listed above is in the evaluation. The reader gained insight to the purpose and outcome of the lab.
85% Meets expectations. The student briefly linked observations and conculsions but the evaluation was not as clearly presented as above. It is a good evaluation, but not a great evaluation.
75% Good effort. Like [85%] but the student did not clearly explain how the results supported the purpose and the elimination process was weak. Report relflected students lack of understanding to do the lab. Two of above were poorly executed or missing.
60% Needs improvement. Poor grammar, poor syntax, poor everything. The student did not grasp the purpose of the lab and did not adequately explain his thought processes. Three of above were poorly executed.
Below 60% Unaceptable. Too short to be considered an results statement. Too much is mising Four or more of above were poorly executed.

Below is an example of a conclusion that could have been written for the lab We will critique it.

This experience showed me the concept of density. In this experience, I calculated the density of a metal. I will also did water. I understand the metric system. Aluminum is a metal. It is silver. The metal is heavier than water. the density of my aluminum sample (#12) calculated to be 1.2345 g/mL using the volume by displacement, and 2.27769g/mL

using the calipers to measure the volume of the sample. The density of water at 18°C was 0.996 g/mL.

Density is intensive, I found the two volumes to be very close. The predicted volume was 87 mL, while the measured volume was 85 mL. The percent difference for these two values was 2.0%. This result showed me that density is an intensive property because the density of two samples of metals are close.

I could have had some errors along the way, but I did not. I read the volume and didn't let my partner do it, because he was a dufus. The density of water is 1.00g/mL. I don't understand why I had to measure this as it is a known and accepted value.

Although I have a lot of confidence with my results, I was hoping that my results would have less error. However, I realize that I could have improved my experimental technique. I think the places where most of my errors occurred were measuring the mass of magnesium, and measuring the height of the column of liquid. I should have used an analytical balance to measure the mass of the magnesium. It would have given me more precision. Measuring the height of the column was really hard. It was difficult really knowing where to start reading the ruler, because the surface of the water was in the way. Also, I had to read sideways.

This summary is TERRIBLE. If I were the instructor, I would give this student 50% for effort (maybe less). Here are some reasons I took off points:

- ***The student could have re-evaluated the purpose of the lab, but did not.***
- ***The student gave misleading information in the statement ('it is silver)***
- ***The student did not pay attention to significant figures.***
- ***Nothing was explained. For example, the student says density is intensive because the volumes were close. What volumes? How are they related?***
- ***The student should have explained how the error affected the results. For example, if the volume is too small, the density would be larger. A large volume could be due to using the tool wrong.***
- ***The student could have compared her results to others in the class to see how valid her error was.***
- ***It seems like the student restated the purpose of the lab, but did not describe what she actually did in the lab.***
- ***I think the student could have discussed what she observed during the lab, like what did the metal look and feel like.***
- ***The student did not do a grammar check.***
- ***I would not work with this student. Calling names is not nice.***

Let's compare this to a better results statement:

The purpose of this lab was to determine the density of a sample of aluminum metal, the density of water at a known temperature, and to explore the intensive nature of density. [*restated purpose]* My sample was silvery grey in color and felt light when I compared it to a similar sized piece of steel. Like many metals, my sample of aluminum was heavier than water. Adding the piece of metal to the graduated cylinder displaced an equal volume of water (I hope it did). [*listed observations]*

I determined the density of my aluminum sample (#23) to be 2.90 g/mL using the volume by displacement, and 2.75g/mL using the calipers to measure the volume of the

sample. I measured the volume and mass of a sample of water at 18.2°C and the calculated density was 0.996 g/mL. [*gave results with SF and units]*

Based on my experimental data for predicting the volume of a secondary aluminum piece, density is intensive. I used the calculated density for displacement to predict the volume of a second piece of metal (65). I found the two volumes to be very close. The predicted volume was 16.0, while the measured volume was 15.9 mL. The percent difference for these two values was 2.0%. If the predicted and actual volumes are similar, the density of the new piece of metal should be similar because density is related to volume. Even without calculating the density of my new piece of metal, I knew that the densities were similar. [*discussed the concept of intensive-ness]*

Although the lab seems simple, I learned that there are many places that errors can occur and those errors will affect my results. Density is related to volume and mass. If I used the calipers incorrectly or read the graduated cylinder without care, the volume might be larger (or smaller than expected). I had problems reading the graduated cylinder, so this could be one source of error. [*gave some discussion of error, expressed knowledge of background materia, could have given more!*]

I had more confidence using the calipers. The % error using the calipers was 1.11% while the % error using the volume by displacement data was 3.7%. Reading errors that result in small volume errors yield calculated densities that are too big. If I understood more about the limits of each of the tools, and statistics and stuff, I think I could discuss the significant figures too. My teacher mentioned something about compounded errors, but I think this is a topic for another class.

Here are the results that you will evaluate, and answer in Canvas:

1. In this lab I learned a lot. First of all, I learned about the metric system and how to use calipers. I also learned how to read a graduated cylinder and use a balance. My density was not close to the accepted density of aluminum. And also, the volume was not either. I got 1 for the density of water.

2. The purpose of this lab was to determine the density of a sample of aluminum metal, the density of water at a known temperature, and to explore the intensive nature of density. Aluminum is a light feeling metal with a dull grey color. When I gently slide the metal into the graduated cylinder filled with water, I noticed it was heavier than water. It sank to the bottom of the graduated cylinder, displacing its volume in water along the way.

   I determined the density of my aluminum sample (#64) to be 2.80 g/mL using the volume by displacement, and 2.73g/mL using the calipers to measure the volume of the sample. The density of water at 18°C was 0.996 g/mL.

   I think density is intensive because when I used the density calculated for sample 64 to predict the volume for sample 87, I found the two volumes to be very close. The predicted volume was 15.9mL, while the measured volume was 16.2 mL. The percent difference for these two values was 2.0%. This result showed me that density is an intensive property because the density of two samples of metals from the same source should be the same or really close.

I could have had some errors along the way. For example, density is dependent on both volume and mass. If the balance was not calibrated, and measured the mass too low, the density would be smaller than expected. I had problems reading the graduated cylinder. I had to remember to keep my eye level with the meniscus. So the volumes could be off. If the volume is read to be larger than it really is, the density will be smaller than expect; the reverse is true, too. I had more confidence using the calipers. The % error using the calipers was 1.11% while the % error using the volume by displacement data was 3.7%. Reading errors that result in small volume errors yield calculated densities that are too big. If I understood more about the limits of each of the tools, and statistics and stuff, I think I could discuss the significant figures too. But I think statistics is for another class.

3. In this lab I determined the density of aluminum metal. It was 3.00. I also got the density of water as 1.0000. Aluminum is grey metal, water is clear. This lab provided that density is an intensive property. The errors that could have messed up my density was not using the balance properly, reading the graduated cylinder wrong, and misusing the calipers. Since 3 is really close to 2.70, the real density of aluminum, I think I did not make any errors.

4. This lab did not work. First of all, my partner used the wrong balance. Then he used the same peace of mental for both parts. It is all his fault that we got crappy results. The rulers were really hard to read. The density of aluminum is 2.88 g/mm^3. Our thermometer did not really work well. It said the room was 18°, but it felt warmer than that. So I was surprised when the density of waters was really close to 1 because I thought that density decreases with temperature. I learned that mentals are heavier than water. Because they sink. Also, water is not as dense as mentals.

5. I determined the density of my aluminum sample (#81) to be 2.85 g/mL using the volume by displacement, and 2.77g/mL using the calipers to measure the volume of the sample. The density of water at 18°C was 0.951 g/mL. In part 6 of the experiment I predicted sample 24 to have a volume of 19.00 mL. When I measured the volume by displacement, I found the volume was really close to the predicted value. A really close volume means that the densities of the two samples are the same or really close. So density is intensive. I know I am supposed to discuss error, but I was really careful and did not make any mistakes. I am not sure why my results are not exactly like the expected value, because I worked really slowly and carefully. I learned that density is dependent on both volume and mass. I had more confidence using the calipers. The volumetric ware was kind of wobble, and really hard to read. But I did not make a mistake reading it. the problem was with the graduated cylinder. If it was better made my results would be better. also, the balances were drifting. Again this is not my fault.

THE FOLLOWING HAVE TYPOS, MISSPELLED WORDS, POOR GRAMMAR AND SYNTAX. IT IS PART OF THE EXERCISE TO IDENTIFY THESE PROBLEMS SO YOU DON'T MAKE THEM. ALSO, NONE OF THESE ARE PERFECT.