Precision and accuracy lab report

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Precision describes the closeness of results that have been obtained in exactly the same way while accuracy indicates the closeness of the measurement to its true value. This experiment was used to determine the accuracy and precision of different volumetric measuring devices, as well as determining the density of an unknown metal. This lab was to help understand the application to volumetric measurements. Part 1: First, the next-to-smallest beaker was cleaned, dried, and weighed on the scale where it’s mass was determined.

The container was then tared so the scale would only read the mass of the water. The smallest beaker was used to measure out 14 mL of water. Then, that waster was poured into the pre-weighed beaker and put on the scale. Once the measurement was recorded the beakers were both cleaned and dried. This process was repeated two more times. Second, a 100 mL graduated cylinder was used to measure out 14 mL of water. Then, that water was poured into the pre-weighed beaker and put on the scale. Once the measurement was recorded, the beaker and graduated cylinder were both cleaned and dried.

This process was repeated two more times. Third, a 25 mL buret was used to measure out 14 mL of water. Then, that water was poured into the pre-weighed beaker and put on the scale. Once the measurement was recorded, the beaker and buret were both cleaned and dried. This process was repeated two more times. After recording the mass using three different volumetric devices, each with three trials, density was calculated for each volumetric device and trial. Then, the trials were averaged. This concluded that the buret was the most accurate measuring device.

Last, the average mass of water and standard deviation was calculated, confirming the results that the buret was the most accurate measuring device. Results/Data: Table 1: Mass of 14 mL of water in different volumetric devices Volumetric Device| Mass (g)| | Measurement 1| Measurement 2| Measurement 3| | Pre-weighed| w/ Water| Pre-weighed| w/ Water| Pre-weighed| w/ Water| Beaker| 64. 226| 10. 454| 64. 224| 9. 025| 64. 226| 9. 016| Grad. Cyl. | 64. 225| 12. 715| 64. 226| 12. 158| 64. 229| 12. 211| Buret| 64. 230| 13. 841| 64. 232| 13. 913| 64. 226| 13. 866|

Table 2: Density of Water Volumetric Device| Density| | Measurement 1| Measurement 2| Measurement 3| Average| Beaker| 0. 75| 0. 64| 0. 64| 0. 68| Grad. Cyl. | 0. 91| 0. 87| 0. 87| 0. 88| Buret| 0. 99| 0. 99| 0. 99| 0. 99| Data Analysis: Density of water = 1. 00 g/mL This shows that the buret was the most accurate measuring device since the calculated density (0. 99 g/mL) is closest to water’s true density (1. 00 g/mL). Table 3: Average mass of water Volumetric Device| Avg. mass of water (g)| Standard Deviation| Beaker| 9. 498| 0. 8276| Grad. Cyl. | 12. 361| 0. 0945| Buret| 13. 73| 0. 0366| Part 2: First, the unknown metal (metal D) was selected as the sample to be tested. A weigh boat was pre-weighed on the scale and using the tare function, the direct mass of the unknown metal was recorded. This process was repeated two more times. Second, using a 100 mL graduated cylinder, 10 mL of water was placed into the cylinder. The unknown metal was placed in the cylinder next, and the displacement of water was recorded as the volume. This step was repeated two more times. The density of all three trials was then calculated and those values were averaged.

The unknown metal was determined to be Lead since the density found in the experiment and the density of Lead from the table given was closest in value. Results/Data: Table 1: Mass and volume of the unknown (metal D) Trial| Mass (g)| Volume (mL)| Density (g/mL)| 1| 13. 249| 1. 1| 12. | 2| 13. 255| 1. 1| 12. | 3| 13. 256| 1. 0| 13. | Average Density = 12. g/mL Data Analysis: According to the experiment, metal D ended up being Lead. This is because Lead's density is 11. 34 g/mL and the three trials averaged out to 12. g/mL. Lead was the value closest to the given results.

Table 2: Densities of selected metals Discussion: Both experiments went as planned and had no complications or unexpected events that could have altered the results. The masses measured for the amount of water in each volumetric measuring device are above and indicate the most efficient, precise, and accurate way to measure water. Also above are the results indicating the unknown metal was in fact lead. The data was collected accurately given by the number of trials performed and with the knowledge of precision gained from part one of the experiment.

The results of the first part of the experiment were what I had personally expected. I noticed that the buret had smaller increments of measure and was easier to judge where 14 mL of water would actually fill up to in the volumetric measuring device than the beaker and graduated cylinder. The results of the second part of the experiment also ended without any unexpected data. Of course, the density measured by my lab partner and myself was not as precise as the table with given densities of selected metals, but we came very close to the true value.

In comparison to other classmates' results we came to relatively similar conclusions in each experiment. To make the results of each experiment more valid though, I think there could have been more than three trials for each measurement or time where we could have discussed our results with various other classmates to compare and contrast results. Problem: Precision vs. Accuracy 1.) High precision and high accuracy – A 2.) High precision and low accuracy – C 3.) Low precision and low accuracy – D 4.) Low precision and high accuracy – B