

Chemistry 11
Lab #1
Measurement and Uncertainty

Name: _____
Date: _____
Block: _____

Purpose

To determine the uncertainty associated with various measuring devices.

Procedure

- 1) Balances Weigh the same cylinder with five different balances to two decimal places (i.e. 2.53 g)
- 2) Thermometers Measure the temperature of water with five different thermometers to one decimal place (i.e. 20.5 ° C)
- 3) Graduated Cylinders Pipette 10.00 mL of water into 5 different graduated cylinders. Read each to one decimal place. (i.e. 10.1 mL)
- 4) Vernier Calipers Obtain 5 estimates of the diameter of a metal cylinder to two decimal places. (i.e. 12.45 mm). Use 5 different Vernier Calipers.
- 5) Micrometers Measure the diameter of the same metal cylinder with two micrometers a total of five times to two decimal places (i.e. 12.80 mm).
- 6) Digital Balance Weigh the same metal cylinder 5 times on 5 different Digital balances to 3 decimal places (i.e. 35.216 g).

Data and Calculations

Record the data for each part **including** the **units** in the data charts below. Calculate the average of the readings. **Round off each number** correctly so that there is only **one** uncertain digit. Determine the uncertainty (the \pm value). The uncertainty can have only **one** digit! It also needs to be in the **same place** as the last or **uncertain digit** of the average. Have a close look at the following examples if you don't want to lose any marks. Make sure that all your data is recorded to the same level of precision. (12.1 mL, 12.2 mL, 12.1 mL, 12 mL, 12.2 mL) The fourth data point should be recorded as 12.0 mL. Note all data has units!

- | | |
|------------|--|
| Correct: | 21.56 \pm 0.03 g |
| Incorrect: | 21.56 \pm 0.2 g Uncertainty does not match last digit |
| Incorrect: | 21.5 \pm 0.02 g Uncertainty does not match last digit |
| Incorrect: | 21.56 \pm 0.29 g Uncertainty has two digits |
| Incorrect: | 21 \pm 0.02 g Uncertainty does not match last digit |
| Incorrect: | 21.56 \pm 0.02 No unit |
| Correct: | 21 \pm 1 g |

Note: your data must be in pen! If you must change data, draw a single line through the old data and write the new data underneath. No whiteout allowed!

Data

1) Beam Balance (0.00 g)

2) Digital Balance (0.000 g)

1		
2		
3		
4		
5		
Average		

4) Thermometer (0.0 °C)

5) Graduated Cylinder (0.0 mL)

1		1	
2		2	
3		3	
4		4	
5		5	
Average		Average	

6) Vernier Caliper (0.00 mm)

7) Micrometer (0.00 mm)

1		1	
2		2	
3		3	
4		4	
5		5	
Average		Average	

Questions

1. Calculate the average and uncertainty for the five measurements of voltage.

12.45 v

12.44 v

12.43 v

12.46 v

12.44 v

2. Calculate the average and uncertainty for the four measurements of current.

45.61 A

45.63 A

44.61 A

45.64 A

3. Calculate the average and uncertainty for the five measurements of length.

0.256 m

0.255 m

0.254 m

0.254 m

0.322 m

4. Do some research and then describe the difference between accuracy and precision.

5. What are is being measured in this lab accuracy or precision?

6. Describe the difference between 1g, 1.0 g, 1.00 g, and 1.000 g.

7. Did any of the instruments used have zero uncertainty? Explain.

8. Explain in detail what is wrong with each measurement below.

a) $25.2 \pm .01$ g

b) 35.21 ± 0.023 mm

c) 3.221 ± 1 g

d) 30.2 ± 4 °C

9. Why is it important to round off measured numbers to the appropriate number of “sig. figs”?

10. On the number line clearly show the range of possible values for the mass determined with the triple beam balance and with a different color show the digital balance.



11. Which balance gave you the most precise mass of the metal cylinder? Is the mass given by the digital balance contained within the uncertainty range of the triple beam balance? Show that it is, if it is.

Conclusion

The conclusion is always placed at the end of the lab report. Write a conclusion that reflects what you set out to do in the purpose. State specifically the uncertainty that is associated with each measuring device explored in this lab. Do NOT include any averages, as these are not important components of this lab. You should also describe why uncertainty is important in scientific research. You might want to think about what the result of overstating or understating the correct uncertainty. Do NOT use pronouns (I, We, You etc). The conclusion should be typed, spell checked, grammatically checked and approximately ½ a page in length. This report should be handed in next day in a Duotang.

