

**Measuring: Precision and Instrumentation****Lab #2****Pre-Lab Discussion**

In class, we learned that the precision of measurements depends on the number of marks on the instrument used to take a measurement *and* on the skill of the person using that instrument. The purpose of this lab is (1) to investigate the limits of how well a group of beginning chemistry students can read common lab instrumentation (rulers, graduated cylinders, and balances), (2) to practice analyzing data, and (3) to write a lab report in the correct format. In class, we discovered that most people with slight training can read instrumentation to about ± 1 in the decimal past the smallest marking.

Research Question

How do markings on an instrument affect precision and accuracy?

Materials

2 triple beam balances, 2 graduated cylinders, 1 regular object, three rulers (printed on back)

Method

- Step 1: Use the data table to record your data. (Station 1 is a dial Vernier balance, station 2 is a regular triple beam balance, station 3 is a 10 mL graduated cylinder, station 4 is a 50 mL graduated cylinder, station 5 is a block but requires data for three rulers.)
- Step 2: Read the instrument at your assigned lab station.
- Step 3: Have your partner read the same instrument.
- Step 4: Compare your answers for academic integrity.
- Step 5: If your answers agree, record your data in your lab notebook and move to the next station, if your answers do not agree within instrumental precision, repeat from Step 1. Measure the block at station 5 three times using the three rulers on the next page. If your answers do not agree on the second try, ask the instructor for help.

Data Collection and Processing

Be sure to measure carefully and check your work with your partner. Ask for help if you cannot quickly agree on an answer. If your answers are close enough, record your own answer, not your partner's and not some average. Be sure to enter your data in the Google classroom document as instructed.

| Data Table | | | | | | |
|--------------|-------------|----------------|----------------|---------|---------|---------|
| Dial Vernier | Triple Beam | 10 mL Graduate | 50 mL Graduate | Ruler 1 | Ruler 2 | Ruler 3 |
| g | g | mL | mL | cm | cm | cm |

Conclusion

For the balance and graduated cylinder data:

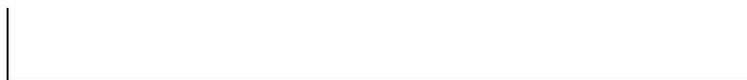
1. In what decimal place is your estimated value appear (tenth, hundredth, etc.)?
2. We saw in class that most people read to ± 1 from the “correct” value. Explain why it is possible that two people reading the same instrument might vary by a range of 2.

For the measurements using rulers with varying number of markings (see below):

3. If the expected range is 0.2 and measured values have a range of 0.4, how good or bad is this precision?
4. Discuss how well the class data fits our expectations for both the balances and the graduated cylinders. Include any observations you may have about which instruments seem to be easier to read and why the data is leading you to believe this is so.
5. Describe how the data changed as the number of markings on the rules increased.
6. What do you notice about the entire class average answer for the length of this object and does it change as much as you predicted or less than predicted as the precision of the rulers increases?

Ruler 1

10 cm



Ruler 2

10 cm



Ruler 3

10 cm



Applications

1. What did YOU (personally) learn?
2. How can any idea, principle, or activity in this lab be used in the real world?