

*Instructions: All answers are to be placed on this sheet.*

Accuracy = how close a measurement is to some accepted, true value

Precision = a term used to describe how close repeated measurements are to each other

Lab Objective: The student will be able to distinguish between the accuracy and precision of estimates made of the measure of several different quantities.

### Procedure 1: Estimating Lengths

- Tear a sheet of notebook paper into 8 equal size rectangles
- Without a ruler, draw a free hand line that you estimate to be 5.00 cm long on one of the sheets. Turn the sheet of paper over.
- Repeat drawing of what you estimate to be 5.00 cm long lines on 3 more sheets of paper, each time turning the sheet over so that you are drawing a line without being able to look at your previous estimates.
- Now measure the length of each line with your metric ruler. Enter these measurements in the data table below. **Remember that you will have 2 digits to the right of the decimal.**
- Hide the first four sheets from sight. Repeat the above process with the remaining 4 pieces of paper, each time turning them over so that you cannot see the other estimates.
- Again measure the actual lengths. Enter the lengths on the data table.

	Measured length	Percent Error ( 5.00 – measure ) / 5.00 * 100
Trial 1		
Trial 2		
Trial 3		
Trial 4		
	Ave. =	Ave. =

	Measured length	Percent Error ( 5.00 – measure ) / 5.00 * 100
Trial 5		
Trial 6		
Trial 7		
Trial 8		
	Ave. =	Ave. =

Calculations and Questions: (Use complete sentences if applicable)

- Calculate the average deviation for trials 1 – 4 and again for trials 5 – 8.

ave. dev. trial 1-4: \_\_\_\_\_ ave. dev. trial 5-8: \_\_\_\_\_

- Which of your two sets of estimates was most accurate? How can you justify your answer?

- Which of the two sets of estimates was most precise? Again, justify your answer?

4. Is the most accurate set also the most precise? Do they have to be? Explain.

Procedure 2: Estimating volume

- a) Measure accurately the length, width, and height of your textbook.
- b) Record your measurements in the data table (**using proper significant figures and units**).
- c) Calculate and record the volume of the textbook (think about proper units and sig figs).

Length: \_\_\_\_\_

Width: \_\_\_\_\_

Height: \_\_\_\_\_

Volume: \_\_\_\_\_

Procedure 3: Estimating time

- a) Using whatever timing device you have available (stopwatch, watch with sweep second hand, etc.) close your eyes and estimate the passing of 20 seconds (sweep second hand or 20.00 s for stopwatch).
- b) Record the actual time that passed.
- c) Repeat 3 more times, each time recording the actual time that passed.
- d) Complete the calculations.

	Measured time	Percent Error $( 20 - \text{measure} ) / 20 * 100$
Trial 1		
Trial 2		
Trial 3		
Trial 4		
	Ave. =	Ave. =

e) Realize that the percent error calculations will be different if a stopwatch was used. The 20 s will be 20.00 s (with 4 significant figures).

f) Describe your timing device: \_\_\_\_\_

g) Did your accuracy improve with practice?

h) Calculate the average deviation of your measured times: \_\_\_\_\_