

Laboratory Exercise 1: Introduction to Measurements of Mass and Density

Reminder: For the safety of yourself and your classmates, you are required to have read and familiarized yourself with the experiment to be performed before coming to the laboratory. **You must show me the first three steps of the scientific method, written in your own words** and different than any of your classmates' summaries, describing the laboratory activity as evidence that you have prepared. **This is your ticket to class**; students arriving without this will not be allowed to participate. Students more than 5 minutes tardy will not be allowed to participate.

Purpose:

The purpose of this experiment is to evaluate measurement uncertainties with General Physics I equipment.

Procedure:

1. Measure the dimensions of the following objects and record your results. Repeat each measurement 5 times—it's important not just to write the same number down 5 times—do each measurement, starting from the beginning, 5 times. For example, take the object completely out of the micrometer jaws, put it back in, and re-measure. Also record the tool used to measure each quantity and the precision of the instrument.
 - (a) Cylinder: Height and Diameter
 - (b) Rectangular Solid: Height, Width, Length
 - (c) Sphere: Diameter
2. Measure the masses of each of the same objects, again repeating the mass measurement 5 times (completely clear the scale between each measurement) and record your results. Also record the smallest comparison mass available, which sets the precision of your measurement.
3. Analysis: Compute the following for each quantity measured:
 - (a) Average (mean)
 - (b) Variance
 - (c) Standard deviation
4. Show all calculations in your notebook.
5. While you are reading this, hopefully well before lab begins, and writing up your "ticket to class", find me in my office (RASP 246) during my office hours (MW 10:25-11:00 and 12:45-2:10, and by arrangement, email to schedule) and have me sign your sheet for an extra "ticket to class" point (worth 1% of your final grade).
6. Compare your calculated standard deviations with the precisions of the measurements.
7. Calculate the volumes of each object.
8. Calculate the densities of each object.
9. Calculate the uncertainties in the volumes and densities of each object. Do this by dividing the standard deviation for each value that went into the calculation by the corresponding value itself, square each one and add them, then take the square root. Multiple by the computed quantity (e.g. volume) and the result is the uncertainty in that quantity.

Laboratory Exercise 2: Free Fall with a Picket Fence

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