Introduction to Measurements and Uncertainty

Make the following measurements and calculations. In each case, decide on a reasonable uncertainty δx to assign to your result. Report your answers in *standard form*:

$$\text{value} = x \pm \delta x \text{ (units)}.$$

See Chapter 2.1 (pp. 13-16) of *An Introduction to Error Analysis, 2nd Ed.* where "standard form" is described in detail.

EXERCISES

1. **Measure the diameter of a well-defined object with a ruler.** See Taylor, Chapter 1.5 (pp. 8-9) for how to estimate the uncertainty when reading scales.

   In your notebook, assign your measured values to variables. For example:

   ```
   my_object_ruler=1.2345     # (cm)
   my_object_ruler_err=0.0006 # (cm)
   print("My object's diameter (ruler) = ", myx, " +/- ", mydx, "(cm)")
   ```

2. **Make a measurement that quantitatively describes the size of a poorly-defined object**.
   - Clearly define and justify the measurement procedure.
   - Justify the estimated uncertainty on the measurement.

3. **Using your measurements from Exercises 1 and 2, *PREDICT* the height of the well-defined object stacked vertically on the poorly-defined object**. See Taylor, Chapter 3.5 (pp. 57-60) for how to add uncertainties in this case.

4. **Stack the balls as described in Exercise 3 and make this measurement directly. Is the direct measurement compatible with the predicted value and uncertainty? Justify your answer.** See Taylor, Chapter 2.3 - 2.5 (pp. 16-24) for what it means to be "compatible".