

PHYS 310 — Homework #1

Reading: (please do before class so we can build on this material in class)

- Hughes and Hase, Chapter 2 and 3.1–3.4
- PHYS 211/212 Lab Manual Appendix: *Notes on Propagation of Uncertainties and Statistics* (posted on the course HW webpage)

Problems:

Please turn these in as one or more Jupyter notebooks (.ipynb files) and/or PDFs (for handwritten or typed work outside of Jupyter) in your Google Drive folder. If there is more than one file, please create a subfolder for HW1, and make sure all files have an easy-to-understand filename.

For all problems in this course, please use Markdown and/or comments to justify your approach, show equations you're using, and explain your final results in words.

1. Hughes and Hase, 2.2; Add a part (iv) in which you give a properly formatted report of the sensitivity of the photodiode.
2. Hughes and Hase, 2.3
3. Consider the following example data for timing pendulum swings. Assume that the experimental standard deviation for the experimenters' timing of pendulum swings is $s = 0.04\text{ s}$. In experiment A the experimenters timed 12 sets of 10 swings, and in experiment B the experimenters timed 1 set of 120 swings.

Results of Experiment A: Average time for 10 swings = 28.39 s.

Results of Experiment B: Time for 120 swings = 340.61 s.

Determine the value of the period for each of these experiments including the uncertainty ΔT (with proper formatting). Discuss which one is more precise and explain why. Do you see any limitations on the more precise method?

4. Consider the following results for the measurement of the period of pendulum (in seconds): $\{4.1075, 4.39831, 4.19365, 4.20259, 4.26921, 4.13037, 3.97548, 4.51314, 4.01286, 4.0101, 4.15578, 4.35153, 4.30801, 4.21082, 3.94315\}$. Without using a computer, a

calculator, or any other method of quantitative computation, estimate the mean and standard deviation of the measurements. Justify your method.