Pre-Lab Practice: Measurements and Error Propagation

Review the Textbook:
- PHYS 1401: Serway & Vuille: Appendix A and Chapter 1.

Practical Population Standard Deviation: \( \sigma = \sqrt{\bar{X}^2 - \bar{X}^2} \)

Practical Sample Standard Deviation: \( s = \left( \frac{n}{n-1} \right) \sigma \)

The instantaneous speed of a car measured from the speedometer reading every second for 10 seconds, in units of miles per hour are: 0, 1, 9, 11, 17, 10, 28, 40, 36, 55.

1. The average of the above readings in mph is about (21)
2. The sample standard deviation of the above readings is about (18)
3. The mass of a ball is measured as (60.2 ± 0.5)g. What is the same measurement, given with a percent uncertainty? (60.2g ± 0.83%)
4. How many significant figures does the measured value of the mass of the ball have? (3)
5. A mass of a box is described as 52 ± 0.5 kilograms, what is the range of values, in kilograms in which you expect to find the mass of the box? (51.5, 52.5)

6. The volume of milk in a jug is determined by pouring it out into a container, first using a 50.0 ml jar in which a 0.5 ml error in measurement is estimated and then using a smaller 5.0 ml flask in which a 0.25 ml error in measurement is estimated. The milk was poured out 5 times using the 50.0 ml jar and 8 times using the 5.0 ml flask. What is the measured volume of milk in the jug, in ml? State in the standard form (Total volume ± estimated uncertainty in volume) (290.0 ± 4.5) (Alternative: 290 ± 5. It’s common to round the uncertainty to one significant figure.)

7. The dimensions of a table are measured with a meter stick. The length of the table is measured 3.431 m and width of the table is measured 2.187 m. The uncertainty of each of these measurements is 2 mm. What is the area of the table in m² and its uncertainty? (7.504±0.011) (Alternative: 7.50 ± 0.01. It’s common to round the uncertainty to one significant figure.)