Prelab: Experiment #9 – Projectile Motion

Read the lab and find the equations necessary to answer the following questions. Neatly derive the uncertainty formulas for those equations. There are several calculations to be done for this lab.

Use MS Excel to prepare a spreadsheet to help you do the calculations in the lab with your experimental data. If an uncertainty formula derivation takes several steps, have each step in the spreadsheet. This makes it easier to find mistakes. For example, suppose $R = v_o t + \frac{1}{2}at^2$, where we measured v_0, a, and t. Let $A = v_o t$ and $B = \frac{1}{2}at^2$. Your spreadsheet would have

1	A	B	C	D
2		measurement	unc	Rel unc
3	v_0			
4	a			
5	t			
6	$A = v_o t$			
7	$B = \frac{1}{2}at^2$			
8	R = A + B			

1. A student levels the bent projectile tube and measures the ends to be 1.50 ± 0.01 m and 1.01 ± 0.01 m above the floor. The student then adjusts the tube height so that the ball bearing just turns around at the far end when released. The heights are now 1.32 ± 0.01 m and 1.28 ± 0.01 m. Take g to be 9.81 ± 0.01 m/s^2. Predict the velocity that the ball bearing will leave the tube. [2.511 ± 0.113 m/s]

2. The student measures the diameter of the ball bearing as 20.0 ± 0.1 mm. He finds that the ball bearing has to drop 0.95 ± 0.01 m to the timing plate. Predict the time the ball bearing will be in the air.
[0.4378 ± 0.0026 s]

3. Predict the range of the ball bearing.
[1.099 ± 0.056 m]

Note, you will not be allowed into the lab until you show that you have done the pre-lab and have properly prepared the introductory portion (Title, Goal, Theory Summary, and Uncertainty Derivations) of the lab in your notebook.

No extra lab time will be allowed for the time you miss because you are unprepared.