LAB2: 1-D Motion

Goal: Find the acceleration due to gravity of a dropping ball or, Find the constant acceleration of a ball rolling down a ramp.

Method: On our website, select the video for the 1-D motion you did NOT already analyze when we were first learning about Vernier's Video Software Programs. In either case, we will assume that the acceleration of the ball is constant (angle of incline does not change and ramp is uniform, acceleration due to gravity in free fall is constant). Displacement, *s*, is related to time, *t*, by the equation:

$s = ut + 1/2at^2$

Use the Video Analysis Program to measure the time for the ball to roll / fall from different distances (at least 5). You should collect 3 consistent times from each distance (3 trials). Be sure to organize your data in a table with uncertainties included. Uncertainty for the distance should be based on the smallest division of the ruler (perhaps increased to include limitations of human eyesight during each trial) and uncertainty for time should be based on range of the 3 trials (maximum - minimum/2). Each group member should collect their own data and organize their own tables and make a scatterplot with distance on the y-axis and time on the x-axis. Eventually, you will use the graph of your data to estimate the acceleration, *a*, of the ball.

General Lab Report Requirements:

1. Submit ONE per person before deadline to Turnitin.com
2. Raw and processed data table(s)
3. TWO graphs (original and linearized)
4. Conclusion

More specific instructions on next page…

<u>Data Tables</u>:

1. Numbered and titled (title describes measurements contained in table) - above
2. Column headings have units and distance column has ONE uncertainty at the top of column.
3. Separate column is created to represent the uncertainties in time from each distance based on the range of the trials/2
4. Average time is calculated for the three trials from each distance.

<u>Graphs</u>:

1. Numbered and labeled as a <u>Figure</u> (below graph)
2. After Figure #, a short caption describing what the graph represents
3. All axes labeled with units
4. All graphs have both x and y error bars. If error bars are too small to be seen, consider making them larger for the purpose of the graphing exercise. Explain reasoning for any changes.
5. Linearized graph shows best fit line plus max and min lines that are labeled appropriately

<u>Conclusion</u>:

1. Short statement addressing the GOAL of the lab
2. Use the slope of your linear graph to estimate acceleration. Be able to connect this slope to the SUVAT equation. Use the difference between the slopes of your MIN and MAX lines to represent the uncertainty in your acceleration value. Write this accordingly
3. List ONE random and ONE systematic error and how you might remedy those in the future