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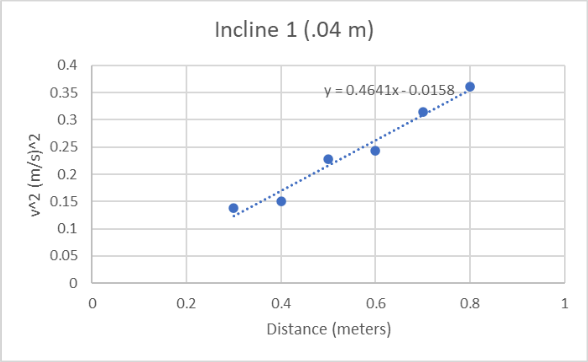
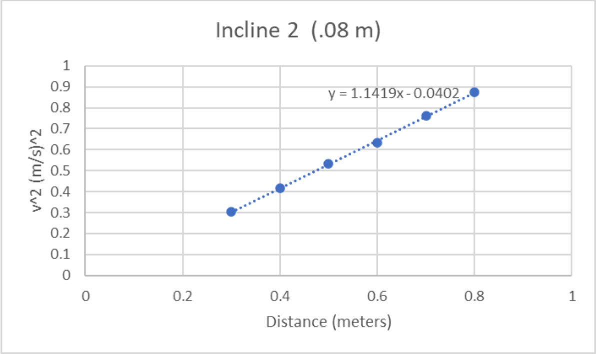
Acceleration on an Inclined Lab Report

Observation:

In the lab, an observation I noticed was that as the distance (m) increased, the average velocity^2 increased. Also, as the incline increased, the overall average velocity of each object increased.


Incline 1 (.04 m)


Incline 2 (.08 m)

Analysis:

Linearizing data is important because it allows us to visualize the relationship between several different parameters clearly. In order to linearize the data collected from this lab, we first need to choose an equation that will allow us to show a relationship between velocity (m/s) and change in position (Δx/m) since those are the parameters we measured.

Out of the big four kinematic equations, the no T equation, or v^2 = vo^2 + 2aΔx, works best for linearizing this data because it does not contain time, which we did not measure for, and shows a relationship between velocity and change in position.

Since the equation of a line is y = mx + b, and assuming acceleration is constant, we do not have to use algebraic manipulation in order to get the no T equation in this format. Since vo = 0, it cancels out of the equation - making the new equation: v^2 = 2aΔx. Hence, the y-value is v^2, and the x-value is Δx. The remaining part of the equation, 2a, is the slope. Since the y-value is v^2, that means we have to square each of our average velocities before we graph them.

In order to make the equations of the best-fit line in terms of v^2 and Δx, we are able to disregard the y-intercept since it is close to zero.

The equation of best-fit line for Incline #1 (0.04m) is: v^2 = 0.4641Δx

The equation of best-fit line for Incline #2 (0.08m) is: v^2 = 1.1419Δx

To find the acceleration of the graph, we set the slope of the best-fit line equal to the slope found in the graph.

Experimental acceleration for Incline #1 (0.04m): 2a = 0.4641

a = 0.23205 m/s^2

In order to find the expected value of the acceleration, we use the equation: a = g*sin(θ)

The height of the ramp (opposite) was 0.04m, and the length of the ramp (hypotenuse) was 1.065m.

Expected acceleration: a= 0.36808 m/s^2

Expected error: -36.8%

Experimental acceleration for Incline #2 (0.08m): 2a = 1.1419

a = 0.57095 m/s^2

Expected acceleration: a = 0.73615 m/s^2

Expected error: -22.4%

Conclusion and Sources of Error:

Some possible sources of error that may have occurred in this lab are: an inaccurate measurement of distance from the cart to the sensor, the screw attached to the cart shifting which may have affected the distance recorded, inaccurate measurement of the book height and ramp length, inaccurate measurement of velocity by the sensor, and there may have been friction present between the cart and the ramp.

The measurement I have the least confidence in is the change in distance from the starting point to the sensor. I believe that due to the screw shifting throughout the lab, and not being able to precisely tell the location of the cart on the ramp impacted the accuracy of our results. Due to possibly underestimating the distance consistently, this may have led to a smaller experimental result compared to the expected result.