Acceleration on an Inclined Plane Lab Report

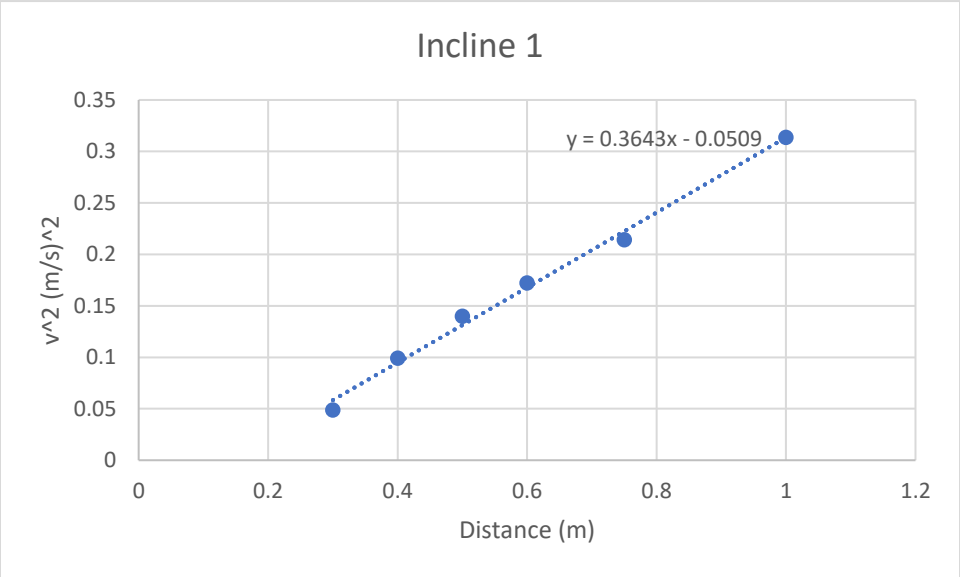
Maya Sushkin

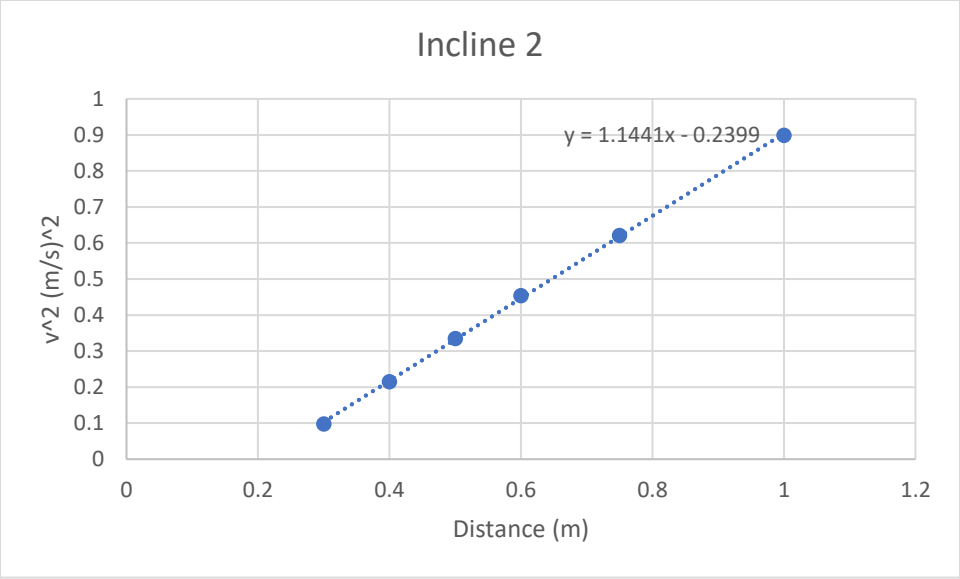
9/18/23

Analysis:

Concluding the lab, many observations were made by my lab partner and myself. The main one, being that acceleration increased as the slope of the incline increased. Furthermore, acceleration also increased as the distance from the photogate sensor increased.

Graphs were made and are as follows:





Acceleration Calculation:

The formula

$$v^2 = v_0^2 + 2a\Delta x$$

Can be rearranged to find acceleration (a) using that the initial velocity (v_0) is equal to zero (0)

$$a = v^2/2\Delta x$$

Therefore, plotting the y-axis as v^2 and the x-axis as distance (Δx) will make it so that the slope of the graph divided by two will equal acceleration.

For Incline 1 the line of best fit was

$$v^2 = 0.3643\ \Delta x - 0.0509$$

$a = 0.3643/2$

$= 0.18215\ m/s^2$

For Incline 2 the line of best fit was

$$v^2 = 1.1441\ \Delta x - 0.2399$$

$a = 1.1441/2$

$= 0.57205\ m/s^2$

Conclusion:

The results of the lab are as follows:

The acceleration of the cart was found to be 0.18215 m/s^2 for incline 1, and 0.57205 m/s^2 for incline 2.

However, these results may not be very reasonable as there were possible sources of error.

For example:

- Distance from sensor could vary (between trials) possibly causing variation in velocity data.
- Friction was not taken into account in data analysis. Friction will cause measured speed to be lower, making acceleration calculations lower than expected.
- Cart was not very stable and would roll off track, possibly cause uncertainty in measurement.

Percent Error Calculation:

Expected value of acceleration: $a = g \sin(\theta)$

Percent error: [(expected – experimental)/expected] × 100%

For Incline 1:

$\sin(\theta) = 0.04\ m / 1.09\ m$

$a = (9.8\ m/s^2)(0.04\ m / 1.09\ m)$

$a = 0.3596\ m/s^2$

$(0.3596\ m/s^2 - 0.18215\ m/s^2)/ 0.3596\ m/s^2$

$= 49\%$

For Incline 2:

$\sin(\theta) = 0.08\ m / 1.09\ m$

$a = (9.8\ m/s^2)(0.08\ m / 1.09\ m)$

$a = 0.7193\ m/s^2$

$(0.7193\ m/s^2 - 0.57205\ m/s^2)/ 0.7193\ m/s^2$

$= 20\%$

The objective of the lab was to find the acceleration of the cart. The acceleration measured was 20%-50% lower than the expected value. This matches the prediction that the acceleration would be lower because of friction.