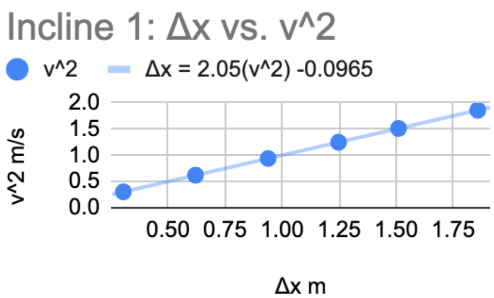
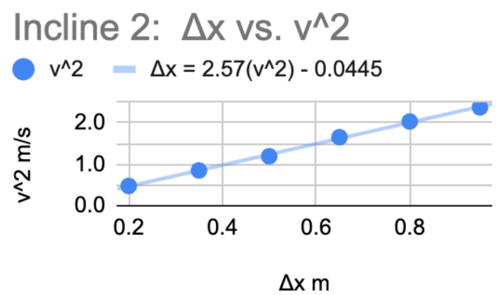
Analysis:





In this lab, we measured the velocity of the cart at different distances along the incline plane. Our goal for this was to find the overall acceleration at the incline of the plane. Considering that for each incline, we had displacement, starting velocity, and final velocity, and we aimed to find the acceleration, I applied the equation $v_f^2 = v_0^2 + 2a\Delta x$. I got rid of v_0^2 because v_0 is 0, since we didn't use any force to start moving the cart. Now, $v_f^2 = 2a\Delta x$ is left. If this can be displayed linearly, then the slope of the equation would be 2a.

To achieve this, instead of representing each data point on the y-axis as v_f, each data point can be represented as v_f^2. The values for Δx are on the x-axis because that's what we specifically moved ourselves during the lab. This means it is the independent variable, which is on the x-axis. The data points for v_f^2 are on the y-axis because they were changed as a response to the change in the distance. This makes it the dependent variable, which goes on the y-axis. By doing this, the data is represented as a line, which means it has a constant slope. Two scatter plots were made, one for each incline. Then, a trendline was added to find the overall slope of these points. This is shown in the two graphs above.

Conclusion:

The data was represented in the form of a scatter plot. This scatter plot has a linear trendline with an equation in the form of $v_f^2 = 2a\Delta x$. Based on the equation, the slope must be 2a. This means for incline 1, 2a = 2.05m/s^2, so a = 1.03m/s^2, and for incline 2, 2a = 2.57m/s^2, so a = 1.29m/s^2. These are our experimental values for acceleration.

The expected value for acceleration can also be calculated using the measurements we got for length and height. The formula for acceleration is a = g sin(x), where x is the angle opposite the height of the triangle. Since we have the height and width, there are two ways to approach this. One is that knowing that sin (x) = height/hypotenuse. We can find the hypotenuse using the Pythagorean theorem, and then plug in all the values in to find a. The other way is to take the tan inverse of the height divided by the width and plug that in for x to solve for a. We know gravity is -9.8m/s^2. For incline 1, the height was 0.116m and the width was 1.117m. Using both methods, the final acceleration came out to be 0.97 m/s^2. For incline 2, the height was 0.153m and the width was 1.17m. The final expected acceleration was 1.27m/s^2 using both methods.

The percent error can be calculated for each one. The percent error for Incline 1 is 6.19%, and the percent error for Incline 2 is 1.57%. The percent error indicates how much the experimental error is off from the expected value. Both percent errors are positive, indicating that the experimental values were greater than the expected values. However, the percent error for Incline 1 is much larger, indicating that the experimental value for Incline 1 was further from the expected value compared to Incline 2.

There were a few possible sources of error in this lab that could have led to this difference. The sources of error can be split into two categories: errors in finding the expected value, which led to a decreased expected value, and errors in finding the experimental value that led to an increased experimental value.

For the first type, one possible source of error could be in our measuring tools. They were only accurate to a tenth of a centimeter. In addition, it is possible that they were not that accurate. Both of these could have led to measurements that were different than the actual, and could have led to a smaller expected acceleration value. When doing calculations for the expected value, I had to round down at the end, which means a less accurate value, and less than it actually was. However, the rounding was necessary.

The other type of errors led to an increase in the experimental value. One possible source of error is in the measurement when placing the cart a certain distance from the photogate sensor. Everything was done relative to the straw on the cart, as that was triggering the velocity on the photogate. However, the straw was positioned upright in the middle of the car, which meant we couldn't align it directly with the measurements on the track. This made it impossible to accurately place the cart at the exact distance measured and the same distance for each trial. This could have led to a larger distance than we expected, or variations in distance, which caused higher velocities compared to our measured distances. Also, the stand for the photogate sensor was loose even when screwed fully. This caused it to rotate forward during the trials sometimes. This could have caused the velocity to be measured at a slightly longer distance at times, leading to a higher experimental velocity.