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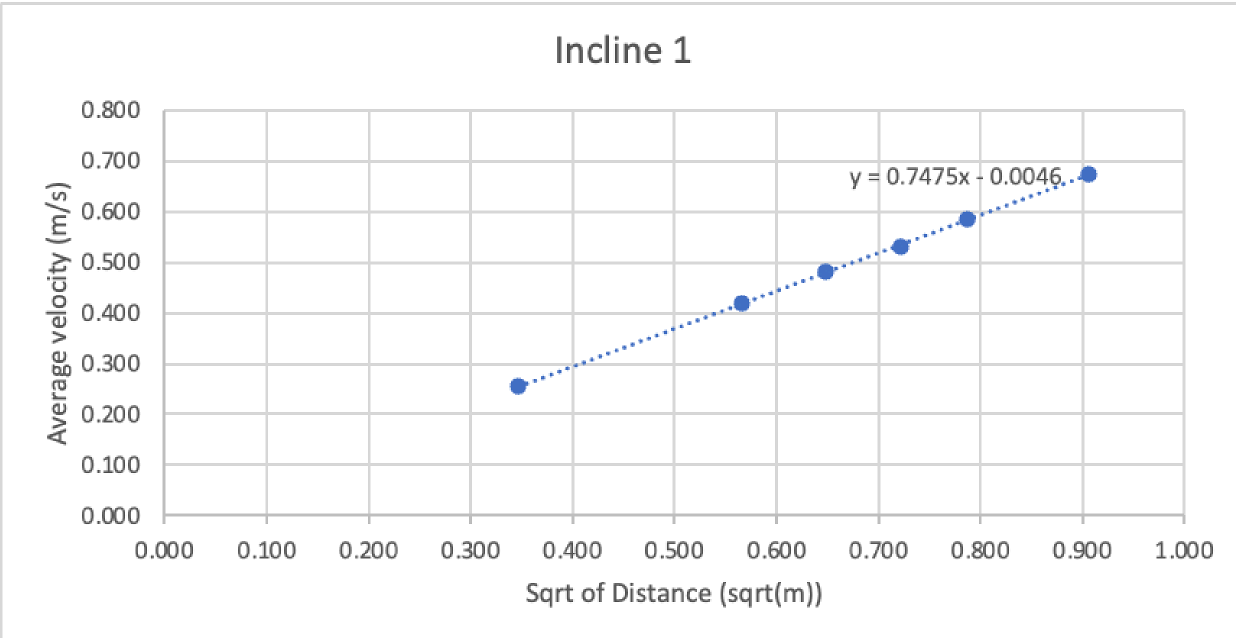
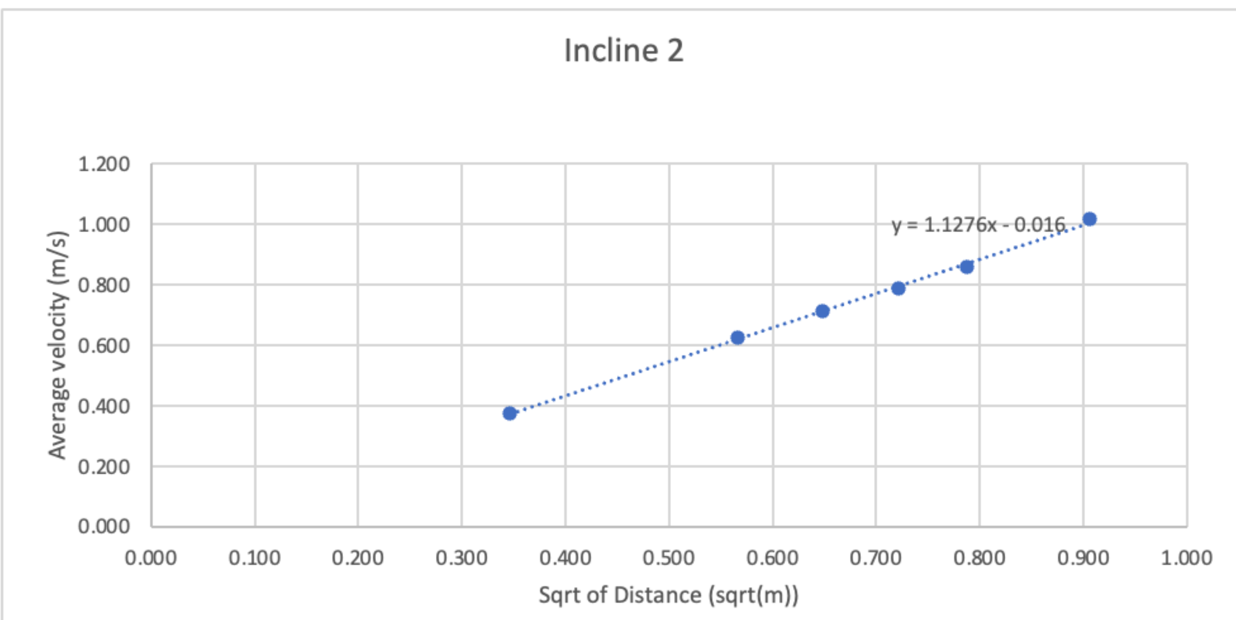
Mrs. Chase

Analysis:

Graphs:





Calculations:

Incline 1:

Measurement Pair	Equation	X-axis	Y-axis	Slope
v, Δx	v^2=v_0^2 + 2aΔx v^2=(0) + 2aΔx v=sqrt(2aΔx)	sqrt(Δx)	v	sqrt(2a)

Equation	Best Fit Line Using Terms of the Measurement Pair Variables	Constant to Solve For	Work Shown
v^2=v_0^2 + 2aΔx	v=0.7475(sqrt(Δx))	a	sqrt(2a)=0.7475 2a=0.559 a=0.279 m/s^2

Incline 2:

Measurement Pair	Equation	X-axis	Y-axis	Slope
v, Δx	v^2=v_0^2 + 2aΔx v^2=(0) + 2aΔx v=sqrt(2aΔx)	sqrt(Δx)	v	sqrt(2a)

Equation	Best Fit Line Using Terms of the Measurement Pair Variables	Constant to Solve For	Work Shown
v^2=v_0^2 + 2aΔx	v=1.1276(sqrt(Δx))	a	sqrt(2a)=1.1276 2a=1.271 a=0.636 m/s^2

Explanation:

In the lab, my group and I measured two variables: distance (in meters) and velocity (in meters per second squared). However, when these two variables are graphed, with distance on the x-axis and velocity on the y-axis, the graph is not linear. I manipulated one of the kinematics formulas to linearize the data, which means to make the relationship between the two variables a linear relationship. I chose the no-time formula, which is $v^2=v_0^2 + 2a\Delta x$, because it has the variables velocity, distance, and acceleration, which is what we're solving for. So, as I've shown above in the tables, to linearize the equation, first I got rid of the term v_0^2 because the initial velocity was 0, making v_0^2 equal to 0 as well. Then, I took the square root of both sides so that I was left with v=sqrt(2aΔx), which is a linear equation. If you split the square of 2aΔx into the square root of 2a times the square root of Δx, the square root of 2a acts as the slope of the equation, and the square root of Δx acts as the dependent variable.

To make a linear graph, I graphed the dependent variable, the square root of distance (sqrt(m)), on the x-axis, and the independent variable, average velocity (m/s^2), on the y-axis. After graphing these points, I used the equation of the line to calculate the acceleration. Since I already defined the slope of the line to be the square root of 2a, to solve for acceleration, all I did was equate the slope of the line with the square root of 2a and solve for a.

Conclusion:

Evaluation of results:

For incline 1, my acceleration value came out to be about 0.279 m/s^2. The expected acceleration is calculated by using the formula a=gsin(θ). In the formula, g is always 9.8 m/s and θ is the angle of incline. To find the angle of the incline (θ), I used the measurements of the height (4.0 cm) and length (102.0 cm) of the incline taken during the experiment. Since the height of the incline is opposite to the angle of the incline (θ) and the length of the incline is like the hypotenuse of a right triangle, sin(θ) equals 4.0/102.0. After plugging into the formula (a=9.8*(4.0/102/0)), the expected acceleration came out to be 0.384 m/s^2. The percent error is equal to ((experimental-expected)/expected)*100, which calculates out to be -27.3%.

For incline 2, my acceleration value came out to be about 0.636 m/s^2. The expected acceleration is calculated by using the formula a=gsin(θ). To find sin(θ), I used the exact same series of steps, except for incline 2, the height was 8.0 cm, and the length was 102.0 cm. After plugging into the formula (a=9.8*(8.0/102.0)), the expected acceleration came out to be 0.769 m/s^2. The percent error is equal to ((experimental-expected)/expected)*100, which calculates out to be -17.3%.

Sources of error:

Since my experimental acceleration turned out to be lower than the expected acceleration, there are a few sources of error I have to consider. The first source of error could be the friction on the carts used to collect data in the experiment. If the carts had any friction between the wheels and the tracks, the velocity and acceleration would be decreased, which is what I'm guessing happened in this experiment. Even though we were in a controlled environment, another possible source of error could be the air resistance. Any air resistance would decrease the velocity and acceleration of the carts, which could explain why our experimental error is significantly negative. An additional source of error could be the measurements of the distances. While my group and I measured the distance the cart traveled as accurately as possible, we most likely weren't perfect. Some small inaccuracies in our measurements of the distances could throw off the calculated acceleration. Since my calculated acceleration was less than expected, that would mean that if we did make mistakes in measuring the distances, we would have measured too little on some of the trials, which would as a result decrease the slope and the acceleration. Since in this experiment the expected acceleration was calculated, there are also some possible sources of error in its calculation process. The only possible source of error in the calculation of the expected acceleration is the height and length of the incline. If my group and I inaccurately measured the height of the incline, we would’ve overmeasured it. An increased measurement of the height would increase the expected value, which would also increase the percent error negatively. If my group and I inaccurately measured the length of the incline, we would’ve undermeasured it. A decreased measurement of the length would increase the expected value, which would resultantly also increase the percent error negatively.