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Physics

Lab Report

Analysis:

By using carts and collecting velocity data at multiple distances from the end of the ramp, we were able to create the graphs below. In our graph, we labeled the y axis "velocity squared" which is significant as without squaring it, the resulting of the best fit function would fail to be linear. The equations of the best fit lines in our graphs with 2 books and 3 books of height were $v = \sqrt{(0.655\Delta x + 0.0032)}$ and $v = \sqrt{(1.13\Delta x - 0.0506)}$ respectively. Our experimental value for a with 2 books is the slope of our graph, 0.655, divided by two which is 0.3275 m/s^2. For the experimental acceleration with three books, we can similarly divide the slope, 1.13, by two and get 0.565 m/s^2.

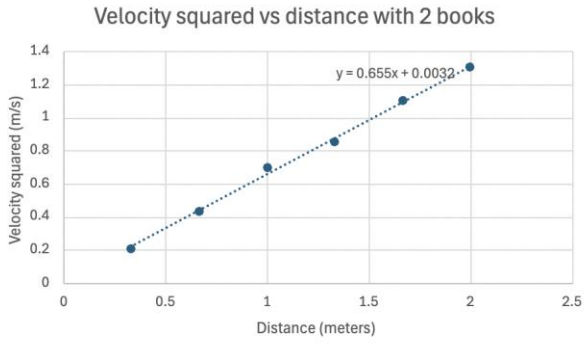
Our data:

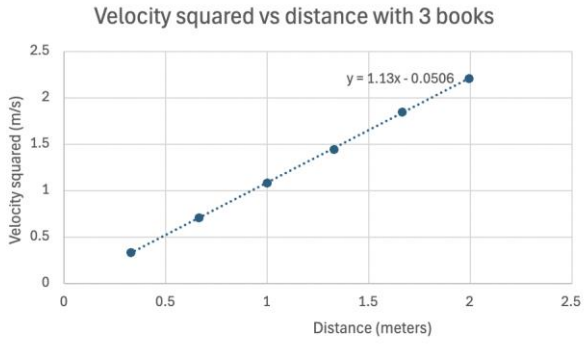
velocity1	velocity2	velocity3	average v	v^2
-1.472	-1.49	-1.495	-1.48567	2.207205
-1.334	-1.377	-1.367	-1.35933	1.847787
-1.177	-1.208	-1.214	-1.19967	1.4392
-1.036	-1.038	-1.046	-1.04	1.0816
-0.848	-0.834	-0.84	-0.84067	0.70672
-0.555	-0.571	-0.581	-0.569	0.323761

v1	v2	v3	avg	v^2
-1.143	-1.146	-1.139	-1.14267	1.305687
-1.03	-1.07	-1.047	-1.049	1.100401
-0.914	-0.922	-0.94	-0.92533	0.856242
-0.838	-0.829	-0.845	-0.83733	0.701127
-0.653	-0.66	-0.665	-0.65933	0.43472
-0.444	-0.461	-0.457	-0.454	0.206116

3 books on left, 2 books on right.

Our graphs:





Conclusion:

Our acceleration for the cart in this experiment was 0.3275 m/s^2 and 0.565 m/s^2 for two books and three books respectively. To find the theoretical value of acceleration we can use the equation $a=g \times \sin(\theta)$. $\sin(\theta)$ is the height of the ramp divided by the length which is 0.105m/2m for two books. $a = 9.8 \times (0.105/2)$. $a = 0.5145\ m/s^2$. For the theoretical acceleration with three books, we can use the equation $a=g \times \sin(\theta)$ again but with the height 0.145m instead of 0.105m. $a = 9.8 \times (0.145/2)$. $a = 0.7105\ m/s^2$. Comparing the experimental and theoretical accelerations, there is a 36.35% error with two books and a 20.48% error with three. Sources of error for this experiment could have been that we measured the height of the books incorrectly and that it was actually less as this would have caused the cart to have a lower velocity. We could have instead of measuring to the track, measured the bottom of the ramp. Another source of error is that we did not account for friction as the cart could have been greatly slowed by the wheels rubbing against the bottom of the track and the grooves that they fit into. The friction would have slowed the cart down and decreased the velocity which makes sense as both of our experimental values were below the theoretical ones.