Determining the Effect of Ramp Incline on Acceleration

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1 Introduction

The goal of this lab was to determine the effect of ramp incline on the acceleration of a cart. I predict that as ramp incline increases, acceleration of the cart will increase linearly.

2 Materials

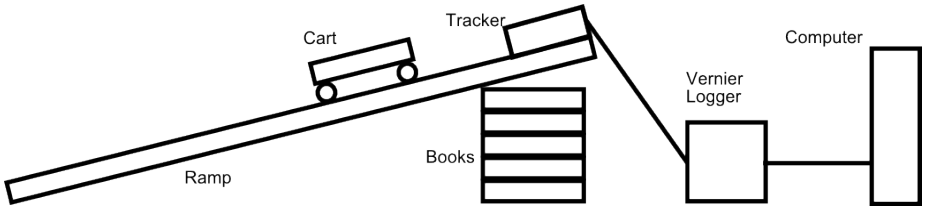
1. 1 Cart
2. 1 Ramp
3. 1 Ruler
4. 1 Vernier Logger
5. 1 Position Tracker
6. 1 Computer
7. 5 Books

3 Procedure

1. Set up Vernier box with position logger
2. Place one book on a flat surface
3. Indicate a constant distance on the ramp
4. Lay one end of the ramp on the book
5. Place position logger on the elevated end of the ramp
6. Place cart at beginning of indicated distance

7. Let go of cart, track acceleration of cart
8. Record average acceleration for the cart
9. Repeat steps 2-7, iterating the book count ($1 \rightarrow 5$)

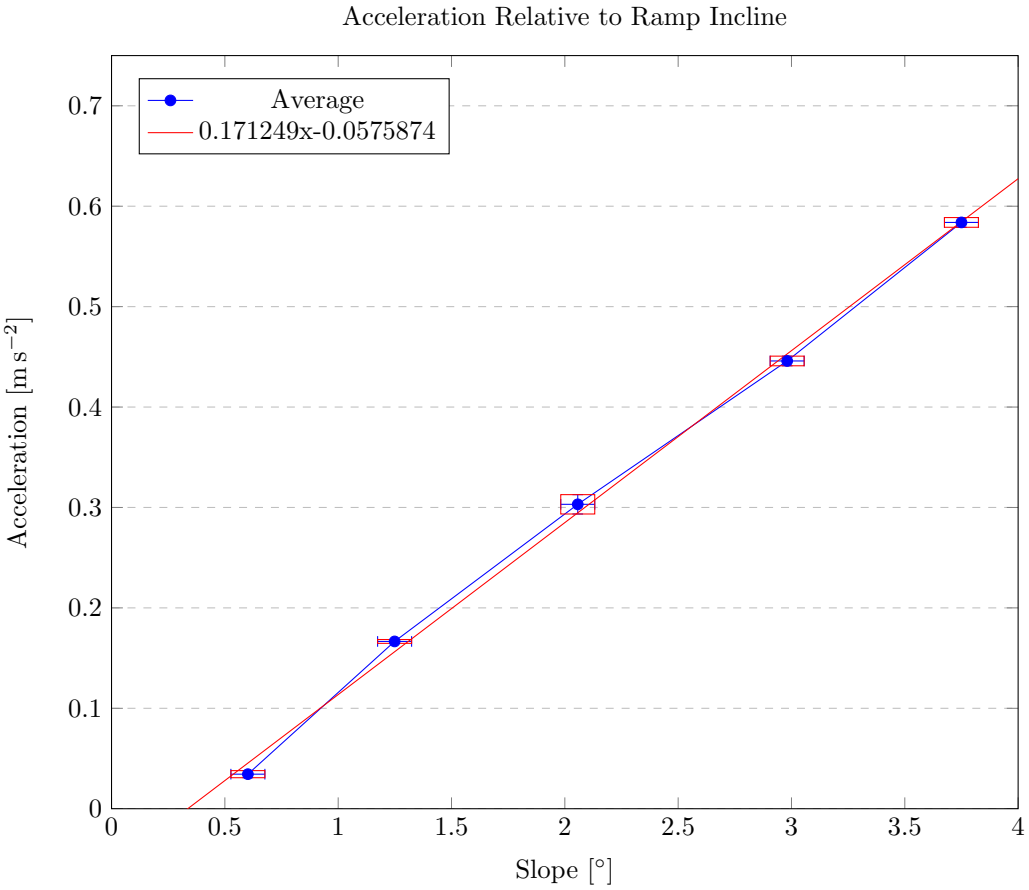
4 Diagram



5 Data

Height	Slope	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average
1.5 cm	0.6016°	$0.031\,72\,\mathrm{m\,s^{-2}}$	$0.032\,57\,\mathrm{m\,s^{-2}}$	$0.033\,46\,\mathrm{m\,s^{-2}}$	$0.037\,95\,\mathrm{m\,s^{-2}}$	$0.036\,37\,\mathrm{m\,s^{-2}}$	$0.034\,414\,\mathrm{m\,s^{-2}}$
3.1 cm	1.249°	$0.1659\,\mathrm{m\,s^{-2}}$	$0.1670\,\mathrm{m\,s^{-2}}$	$0.1683\,\mathrm{m\,s^{-2}}$	$0.1647\,\mathrm{m\,s^{-2}}$	$0.1671\,\mathrm{m\,s^{-2}}$	$0.1666\,\mathrm{m\,s^{-2}}$
5.1 cm	2.057°	$0.3036\,\mathrm{m\,s^{-2}}$	$0.3099\,\mathrm{m\,s^{-2}}$	$0.3007\,\mathrm{m\,s^{-2}}$	$0.3080\,\mathrm{m\,s^{-2}}$	$0.2935\,\mathrm{m\,s^{-2}}$	$0.303\,14\,\mathrm{m\,s^{-2}}$
7.4 cm	2.981°	$0.4492\,\mathrm{m\,s^{-2}}$	$0.4431\,\mathrm{m\,s^{-2}}$	$0.4485\,\mathrm{m\,s^{-2}}$	$0.4476\,\mathrm{m\,s^{-2}}$	$0.4411\,\mathrm{m\,s^{-2}}$	$0.4459\,\mathrm{m\,s^{-2}}$
9.3 cm	3.750°	$0.5887\,\mathrm{m\,s^{-2}}$	$0.5813\,\mathrm{m\,s^{-2}}$	$0.5839\,\mathrm{m\,s^{-2}}$	$0.5808\,\mathrm{m\,s^{-2}}$	$0.5846\,\mathrm{m\,s^{-2}}$	$0.583\,86\,\mathrm{m\,s^{-2}}$
Uncertainty							
0.05 cm	0.075°	$0.003\,536\,\mathrm{m\,s^{-2}}$	$0.0019\,\mathrm{m\,s^{-2}}$	$0.009\,64\,\mathrm{m\,s^{-2}}$	$0.0048\,\mathrm{m\,s^{-2}}$	$0.004\,84\,\mathrm{m\,s^{-2}}$	

Start Point	End Point	Length of Track	Uncertainty
50 cm	192.2 cm	142.2 cm	0.1 cm



6 Analysis

The collected data was remarkably consistent with the linear approximation of the acceleration, with an R^2 value of 0.998. However, there is one error with the data: the acceleration is predicted to be zero when the angle of the ramp is 0.3363°, when the expected value would be 0°. This could be caused by human error at cart launch (pushing the cart forward at launch), of which there were many during data collection, requiring that we repeated some trials. Obviously not all errors were corrected, but this is expected with human uncertainty in data collection. The simple fact is, however, that acceleration increases as ramp incline increases, which supports my prediction.