

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

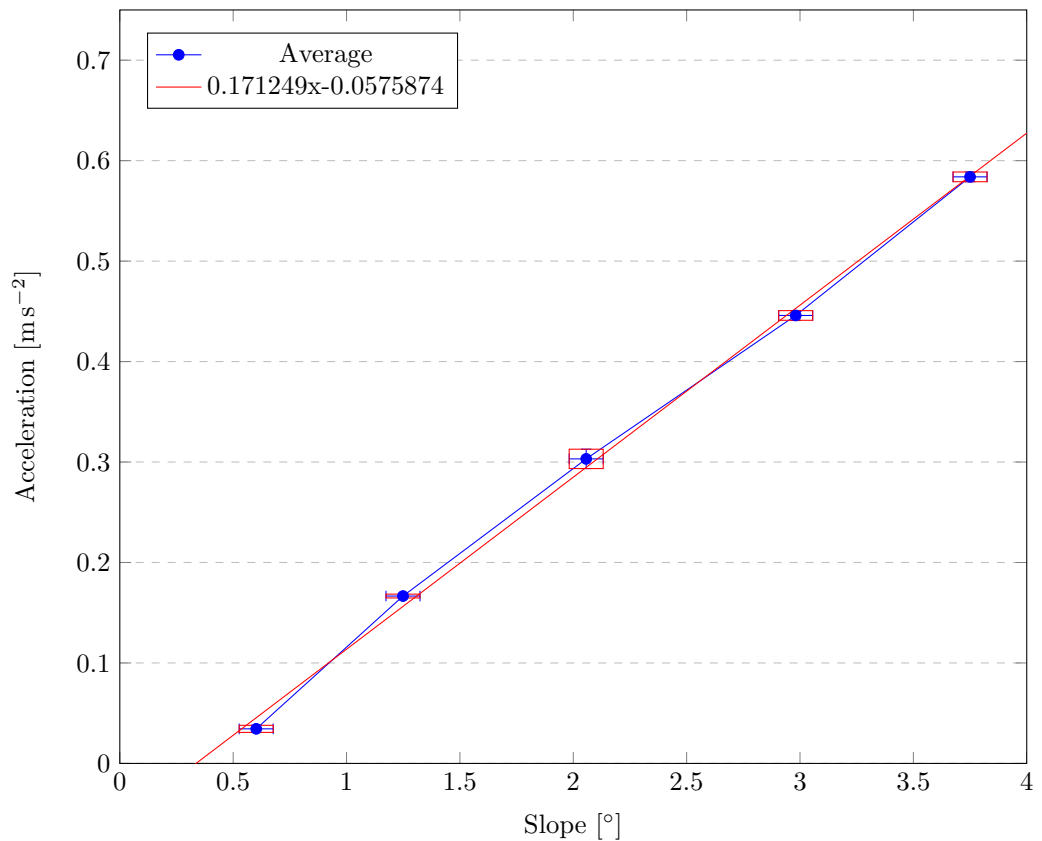
1. Set up Vernier box with position logger
2. Place one book on a flat surface
3. Indicate a constant distance on the ramp
4. Lay one end of the ramp on the book
5. Place position logger on the elevated end of the ramp
6. Place cart at beginning of indicated distance
7. Let go of cart, track acceleration of cart
8. Record average acceleration for the cart
9. Repeat steps 2-7, iterating the book count ($1 \rightarrow 5$)

4 Data

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

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

Acceleration Relative to Ramp Incline



5 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.