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Mr. Thomas

AP Physics C: Mechanics
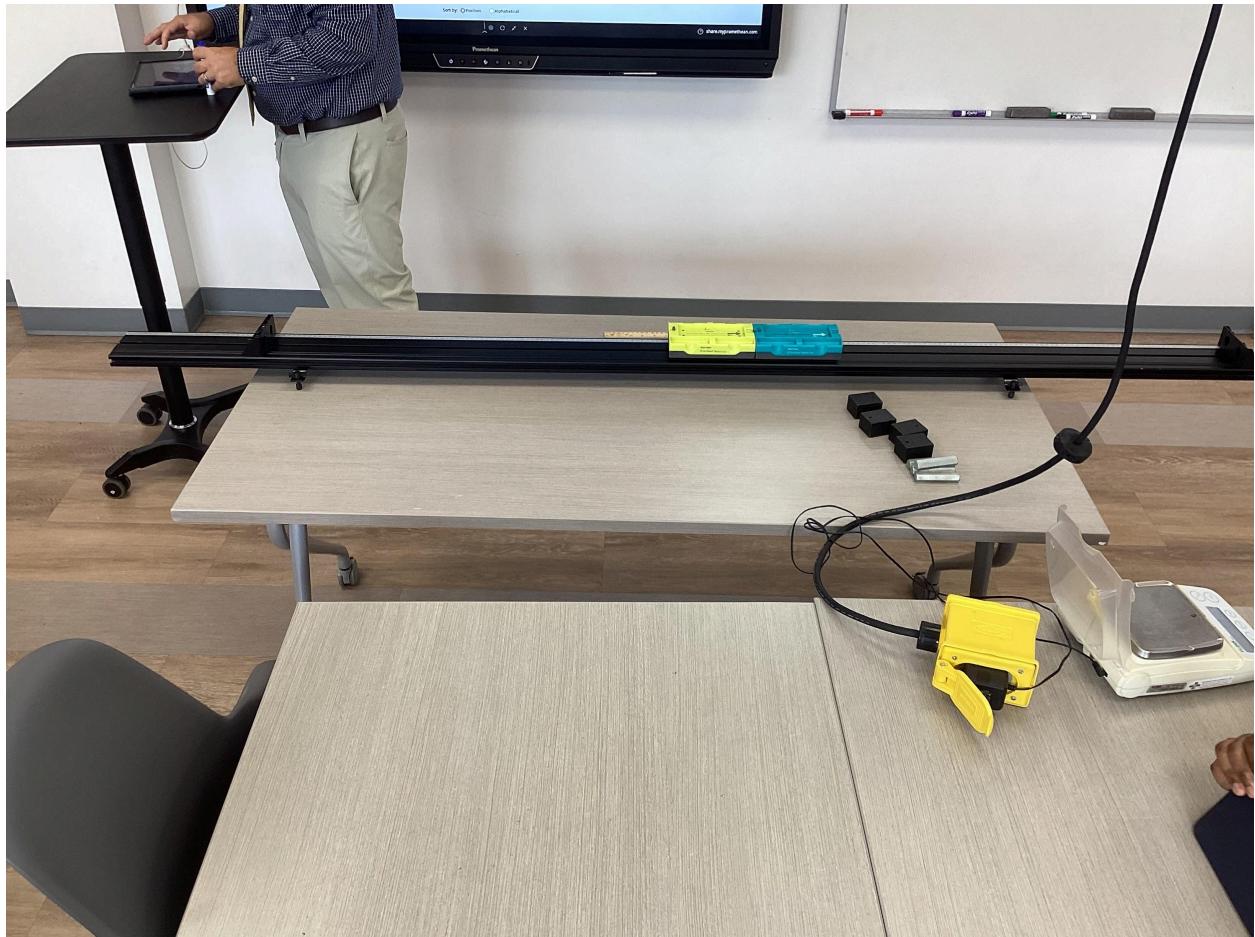
October 22, 2025

Momentum Lab Report

Purpose:

to determine the graphical and mathematical relationship between ratio of masses and ratio of

velocities between the two carts moving apart

Apparatus:

Procedure:

1. Place Vernier Track on flat table

2. Find mass of both carts using a scale

3. Connect carts to Vernier Graphical Analysis App

4. Place both carts near the center of the track

5. Select collect on the Vernier app and press the trigger located on one of the carts to launch the carts

6. Reset carts to middle of track

7. Find mass of a weight and place weight on one of the carts

8. Add mass of the weight to the total mass of the cart

9. Hit trigger and collect velocity

10. Repeat steps 6-9, adding a weight each trial to the same cart and recording velocity

Data Table:

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			Data Set 1				•••		Graph
	M1 (yello… ••• (Kg)	M2 (blue) ••• (Kg)	V1 (yellow) ••• (m/s)	V2 (blue) ••• (m/s)	M1/M2 (Kg) •••	V1/V2 ••• (m/s)	M2/M1 (Kg) •••		1 Graph ▾
1	0.2772	0.2766	0.552	0.558	1.002	0.989	0.998		
2	0.4016	0.2766	0.435	0.624	1.452	0.697	0.689		Data Table
3	0.5258	0.2766	0.354	0.650	1.901	0.545	0.526		
4	0.6505	0.2766	0.308	0.701	2.352	0.439	0.425		Meters
5	0.7748	0.2766	0.244	0.669	2.801	0.365	0.357		
6	1.2975	0.2766	0.158	0.715	4.691	0.221	0.213		Video
7	1.8215	0.2766	0.120	0.773	6.585	0.155	0.152		
8	2.3267	0.2766	0.095	0.788	8.412	0.121	0.119		Notes
9	2.8335	0.2766	0.079	0.799	10.244	0.099	0.098		
10									

Mode: Manual Entry

Graphs and Analysis:

Untitled

V1/V2 (m/s)

M1/M2 (Kg)

Mode: Manual Entry
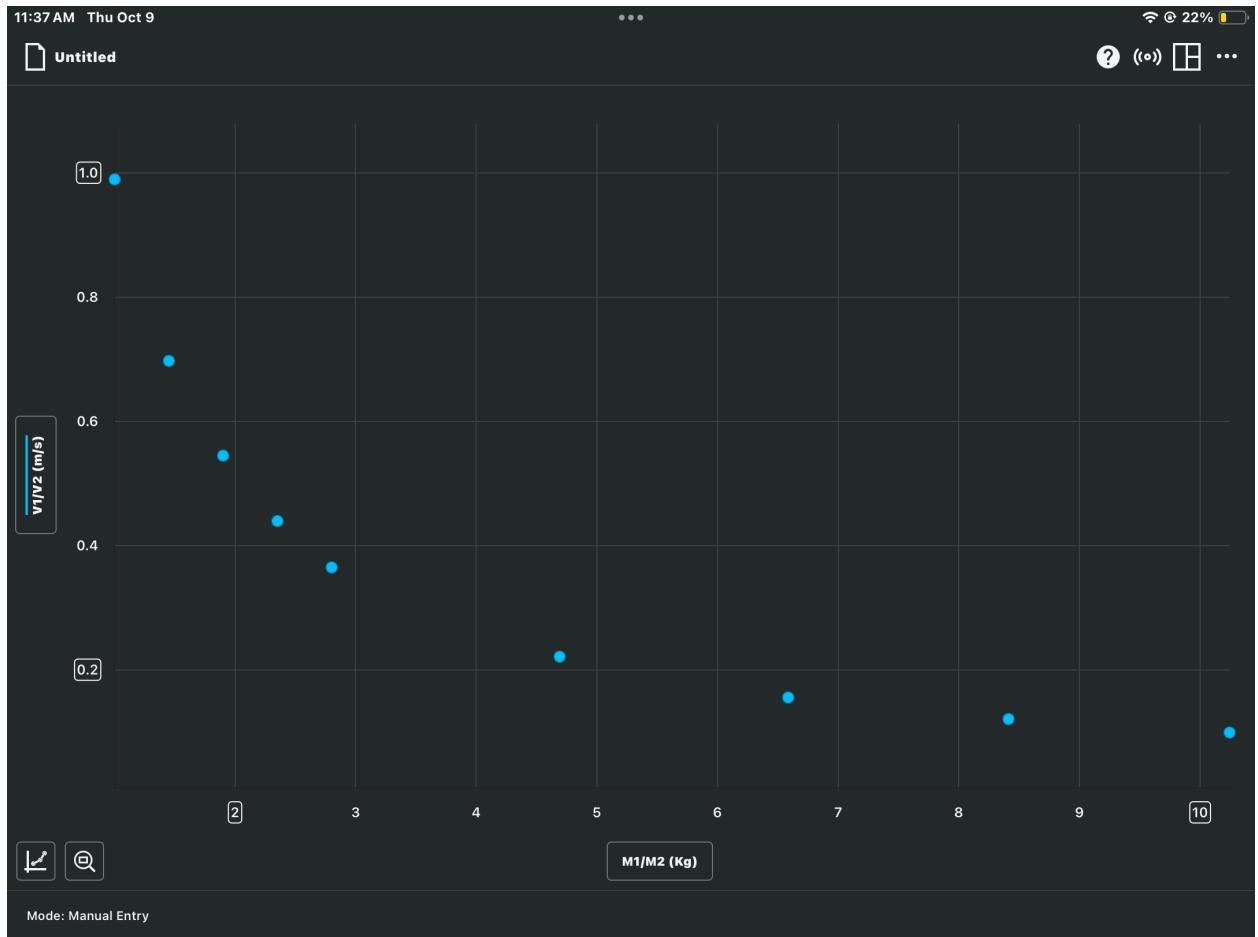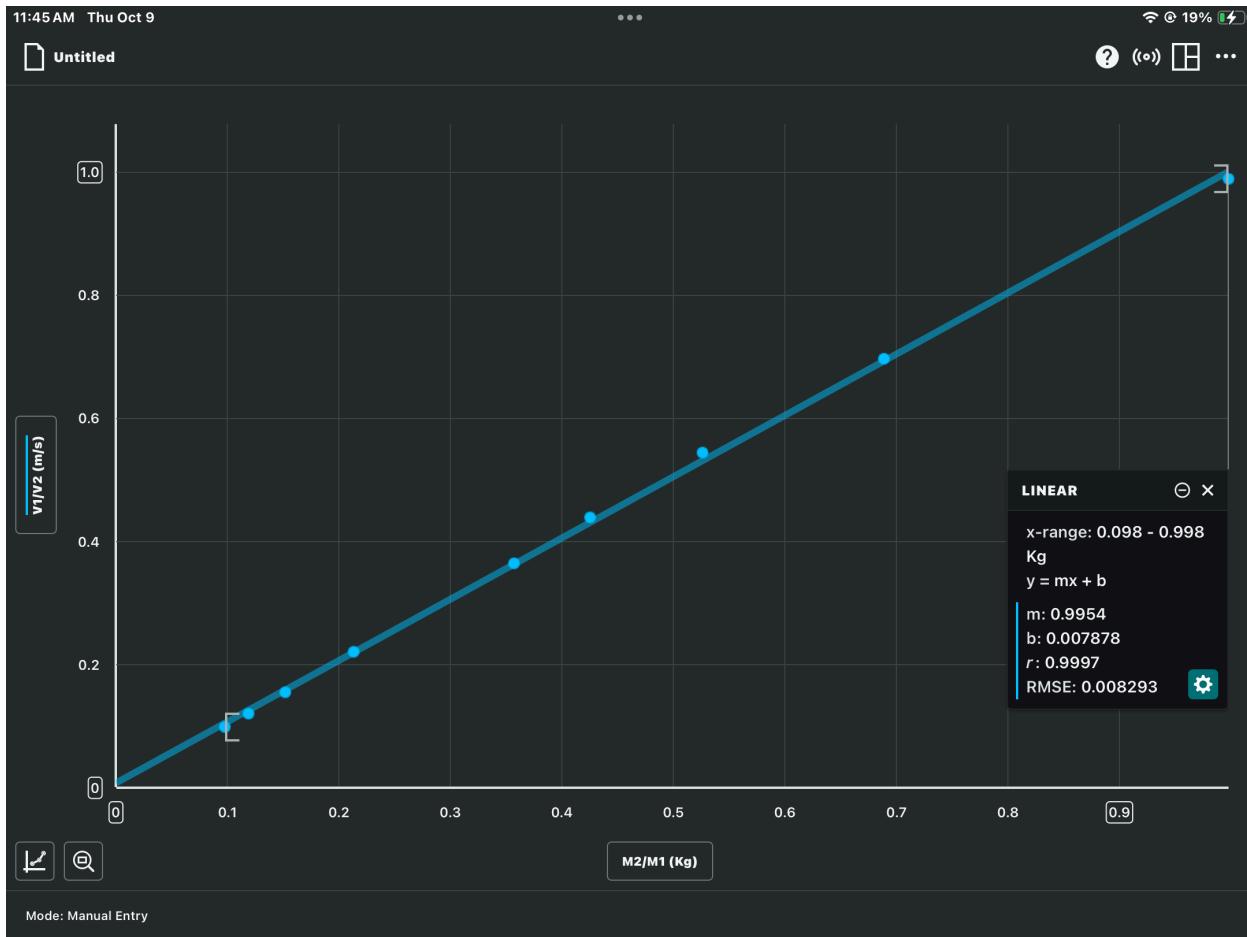
Y=0.9954x

Conclusion:

The data collected in this experiment showcases an inverse relationship between the ratio of masses and the ratio of velocities between two carts that moved apart due to a spring mechanism based interaction. Initially, the raw data was plotted as V1/V2 vs M1/M2. This created a curved graph, indicating that there was a nonlinear relationship between the two ratios. In order to linearize this, we plotted V1/V2 against M2/M1 which yielded a straight line with a slope of approximately 0.9954 and a y intercept which proved to be negligible, making the relationship

between the two ratios proportional. Based on this now linearized graph, we are able to derive

the equation that $V_1/V_2 = M_2/M_1$; from here we are able to manipulate this equation into

$M_1V_1=M_2V_2$, $M_1V_1-M_2V_2=0$. This can also be simplified down into $P_1 + P_2 =0$. These

equations all align with the theoretical model of the conservation of momentum. The slope of

almost 1 reflects this ideal momentum transfer, and the small intercept may be a result of minor

experimental errors. These errors may include friction between the carts and the track,

inconsistencies in the mass of the carts which should be equal, sensor calibration. In order to

improve the accuracy of these trials, we could reduce said friction, calibrate the sensors more

precisely, or get equal cart masses. Overall, this experiment demonstrated the expected

momentum relationship and validated the theoretical model of momentum conservation through

graphical analysis.