Velocity vs. Angle of Ramp Sample Lab Report Mr. Grimes

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Purpose: To determine the mathematical and graphical relationship between the angle of incline of a ramp and the velocity of an object traveling on that ramp.

Procedure: Secure the following items:

A: 1 Pasco 1.2 m frictionless track
B: 1 Pasco car
C: 1 ring stand with hanger and extra bar
D: 1 meter stick
E: 1 Pasco tape timer
F: 1 roll of Pasco timer tape
G: padding for end of track (to protect car).
H: masking or scotch tape
I: protractor

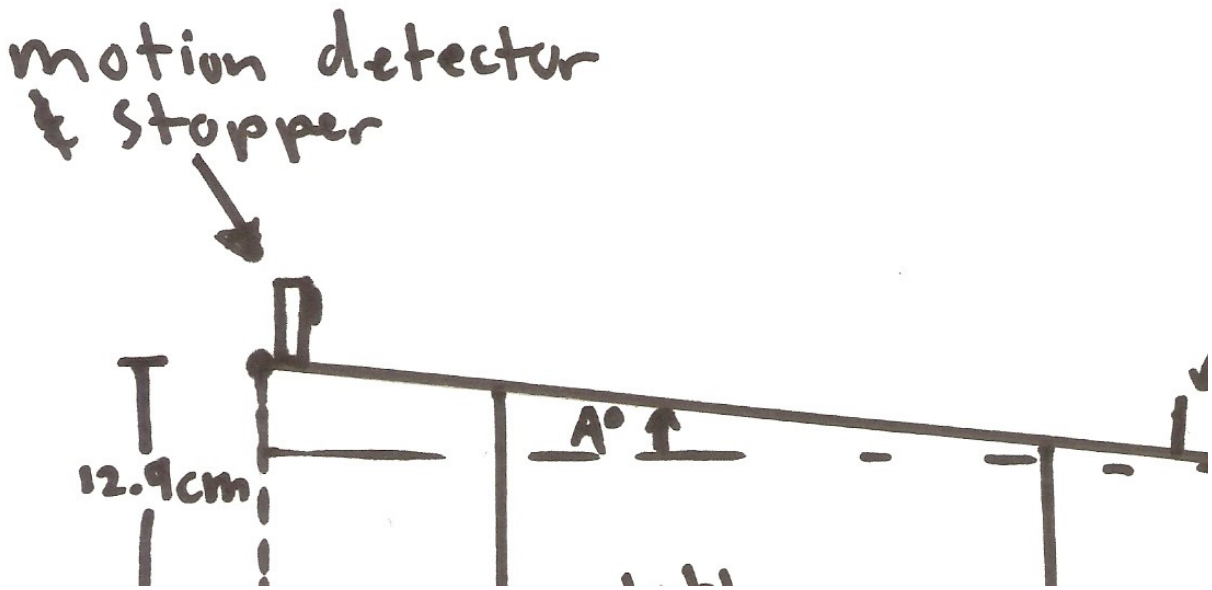
Guidelines given by instructor:

1. Elevated end of track must not be higher than 25 cm above lower end.
2. When using the Pasco tape timer, use only at 10 dots per second.
3. Place padding (towel) at the lower end of ramp to prevent damage to car as it leaves the track.
4. Experiment with no less than five (5) different angles of the ramp spaced somewhat evenly apart. For example, if the highest angle you may use is 20, then you would try to use angles 20,16, 12, 8, 4.

1. Set up the track and parts as indicated in the attached diagram positioning the ramp at your desired angle.
2. SECURE the tape timer to the ring stand ensuring that it is approximately 5 cm higher than the highest end of the track. This allows the tape to line up closely with the height of the vehicle.
3. FEED the timer tape through tape timer (as per the instructions with the tape timer).
4. PLACE the Pasco car on the track so that the back wheels are hanging off of the track. (This will prevent the car from rolling away.)
5. Using the masking or scotch tape, SECURE the timer tape to the car (as per instructions with tape timer).
6. TEST the alignment of the tape by allowing the car to roll down the incline. The tape should move freely through the tape timer. If it does not, adjust the position of the tape timer until it the car rolls freely and the tape does not bind.
7. PLACE and HOLD the car at the highest point on the track.
8. PUSH the timer switch to 10. The timer will begin to make a tapping noise. This is normal.
9. RELEASE the car and allow it to roll to the padding at the end of the lower end of the track.
10. PUSH the timer switch to the OFF position.
11. EXAMINE the timer tape. There should now be small dots on it placed there by the tape timer. If not, refer to the tape timer instruction manual troubleshooting guide.
12. MARK the beginning end of the timer tape with the ramp angle and circle the dot that indicates t_i.
13. Remove the tape from the timer and the car and save it.
14. Go to step one (unless you have enough data).

Apparatus:

Drawing goes here.

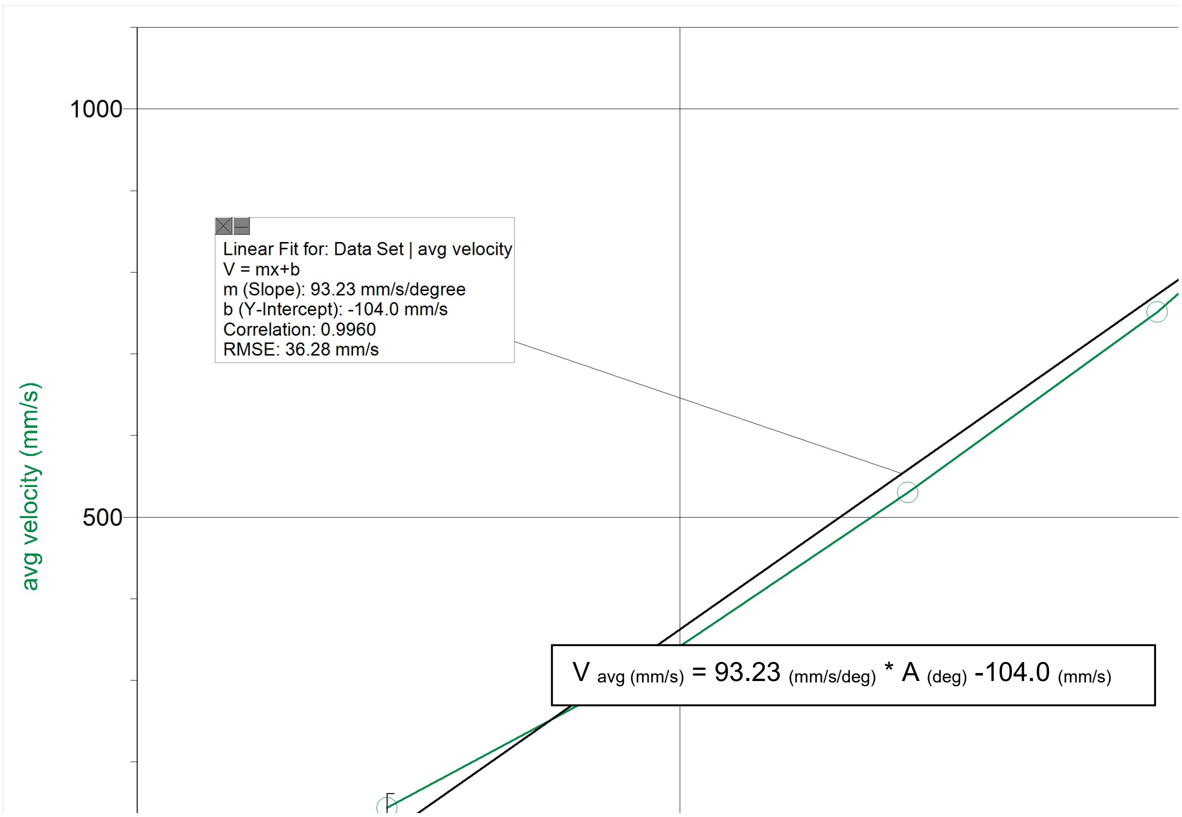


Raw Data:

Angle = 11.8° Height 50 mm		Angle = 9.4° Height 100 mm		Angle = 7.1° Height 150 mm		Angle = 4.7° Height 200 mm		Angle = 2.3° Height 250 mm	
time (s)	disp. (mm)	time (s)	disp. (mm)	time (s)	disp. (mm)	time (s)	disp. (mm)	time (s)	disp. (mm)
0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
0.1	0.5	0.1	2	0.1	10	0.1	14	0.1	21
0.2	4	0.2	11	0.2	29	0.2	40	0.2	59
0.3	12	0.3	27	0.3	59	0.3	81	0.3	116
0.4	23	0.4	49	0.4	97	0.4	136	0.4	191
0.5	37	0.5	76	0.5	146	0.5	205	0.5	285
0.6	53	0.6	111	0.6	203	0.6	288	0.6	397
0.7	71	0.7	152	0.7	271	0.7	384	0.7	527
0.8	92	0.8	199	0.8	348	0.8	494	0.8	677
0.9	117	0.9	254	0.9	434	0.9	618	0.9	846
1.0	144	1.0	315	1.0	530	1.0	751	1.0	1031

Evaluation of Data:

Angle of Ramp (degree)	Displacement (mm)	Time (s)	V_{avg} (mm/s)
11.8	1031	1.0	1031
9.4	751	1.0	751
7.1	530	1.0	530
4.7	315	1.0	315
2.3	144	1.0	144



I believe the data to be linear even though when the data on the x-axis is squared, the correlation gets closer to 1.00.

Conclusion: The relationship between the angle of an inclined ramp and the average velocity produced by a vehicle on the ramp is directly proportional. Examination of the slope indicates that for every degree of angle increase of the ramp, the average velocity increases by approximately 93 mm/s. However, the y-intercept shows that even with an angle of 0 degrees, the velocity of the vehicle would be negative (moving toward the origin) 104 mm/s.

The results of this experiment varied widely between students and myself. Possible reasons for error within my data are 1) table on which the experiment was performed was not level. While it was possible for me to error in reading the measurements on the timer tapes, I don't believe this was the case. When each individual trial was graphed on a motion chart, the resulting graph looked accurate.