Nathan
RSA8

4/29/99
Science Fair Experiment

Fast Physics

Purpose: How can the speed, velocity, acceleration, and momentum of a moving object be determined and recorded as it travels down two different tracks.

Hypothesis: If the car is driven down the cornered track, due to the conservation of momentum it will skid or spin as it rounds each turn. It will decelerate as it goes through the turn, because some of its momentum will be transferred to the ground. If the car is driven down the straight track, the car will simply accelerate to the finish, without lowering velocity, therefore finishing in a much shorter time.

Materials:
- 1 car (small, remote-controlled)
- 1 triple-beam balance
- 2 20ft ropes/strings
- 1 chronographs
- 1 lab partners

Procedure:

PART A:

1. Lay down a driving course with the ropes as seen in Fig. 1.
2. Have a partner stand between corners 1 and 2 equipped with a chronograph.
3. Start the car down the track at a constant power consumption (don't manipulate the controls except when turning the corners)
4. As the car passes each corner and the finish line, have the partner mark the time elapsed since the car's start Also mark the mass of the car with the triple-beam balance.
5. Record the times and calculate speed, velocity, acceleration, and momentum of the car at each corner and at the finish (for corner 1: Speed = 6ft/time; Velocity = Dist/Time; Acceleration = velocity/time; Momentum = velocity x mass of car; etc.).

PART B:

1. Using the same ropes as in part A, lay out a straight course, and have a partner stand at 1/3, 2/3, and at the finish of the track. Proceed as in Part A starting from step 4.

FIG. 1

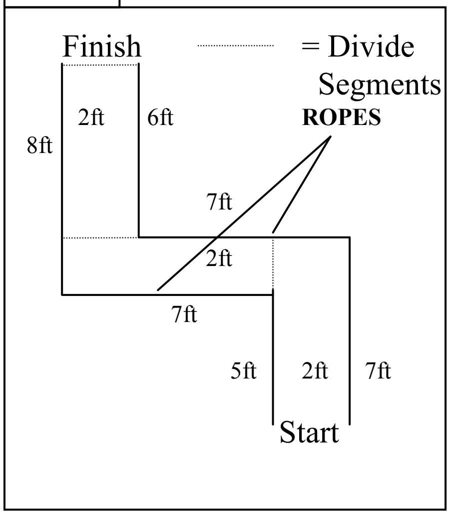
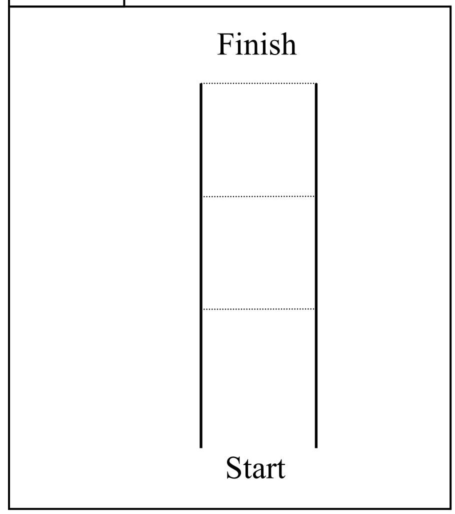


FIG. 2



Car Data/Observations: Part A

at	Mass (kg)	Time (sec)	Distance (ft)	Avg. Velocity (ft/sec)	Acceleration (ft/sec2)	Momentum (ft/sec x kg)	Observations
Start	175kg	0.00sec	0ft	N/A	N/A	N/A	Not moving
Corner 1	175kg	1.63sec	6ft	3.28ft/sec	0.50ft/sec2	574N	Slight skid; Bad control
Corner 2	175kg	1.90sec	7ft	3.68ft/sec	0.52ft/sec2*	644N	*Acceleration Assume V1=0
Finish	175kg	1.28sec	6ft	4.68ft/sec	0.78ft/sec2	819N	Straight course
Formulas	N/A	N/A	N/A	Dist/Time	V2-V1/Time	Vel x Mass	N/A

Car Data/Observations: Part B

at	Mass (kg)	Time (sec)	Distance (ft)	Velocity (ft/sec)	Acceleration (ft/sec2)	Momentum (ft/sec x kg)	Observations
Start	175	0.00	0ft	N/A	N/A	N/A	Not moving
1/3 of Track	175	1.64	6ft 8in	4.07ft/sec	0.40ft/sec2	712.25N	Accl to finish
2/3 of Track	175	1.60	6ft 8in	4.17ft/sec	0.06ft/sec2	729.75N	Accl to finish
Finish	175	1.51	6ft 8in	4.42ft/sec	0.17ft/sec2	773.50N	Accl to finish

Discussion/Results:

In this lab, a remote-controlled car was timed as it moved at a constant power consumption down two different courses to determine the effects of turns on velocity, acceleration, and momentum on the car. One course had two turns, the other was straight. The mass was measured, and the velocity, acceleration, momentum and observations at different points of the courses were recorded. In Part A, the first two segments were identical(except for the second was one foot longer); They both were straight until they turned at the end. When the car rounded the first corner, it discontinued acceleration and slowed excessively, almost spinning out. The control of the car was difficult at that point. The data shows that the acceleration rates of the car in the two segments are very similar (.50 and .52ft/sec2), leading to the belief that rounding the corner was similar to stopping and starting again, proving the concept of conservation of momentum. The conservation of momentum states that momentum can be transferred, but not lost, as the car's momentum is transferred to the ground as it approaches zero velocity at each corner. In Part B, The car continued to accelerate from the start to the finish, supplying more indication that the car approached zero velocity as it rounded the corner in Part A. There is room for error in this experiment, from differing reactions of the controller to bad human error in timing to slightly less powerful batteries, any of which could have slightly altered the results.

Conclusion:

On account of all indications upon completing the experiment, it is concluded that, as stated in the law of conservation of momentum, as an object turns ninety degrees using a constant amount of power, it loses all velocity at one point and all its momentum is transferred into the ground in the form of skidding, spinning, flipping, or bad response to controls.

Fast Physics

Problem: How can the speed, velocity, acceleration, and momentum of a moving object be affected as it travels down two different tracks?

Hypothesis: If the car is driven down the cornered track, due to the conservation of momentum it will skid or spin as it rounds each turn. It will decelerate as it goes through the turn, because some of its momentum will be transferred to the ground. If the car is driven down the straight track, the car will simply accelerate to the finish, without lowering velocity, therefore finishing in a much shorter time.

Materials:

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	1	triple-beam balance
	2	20ft ropes/strings
	1	chronographs
	1	lab partners

Procedure:

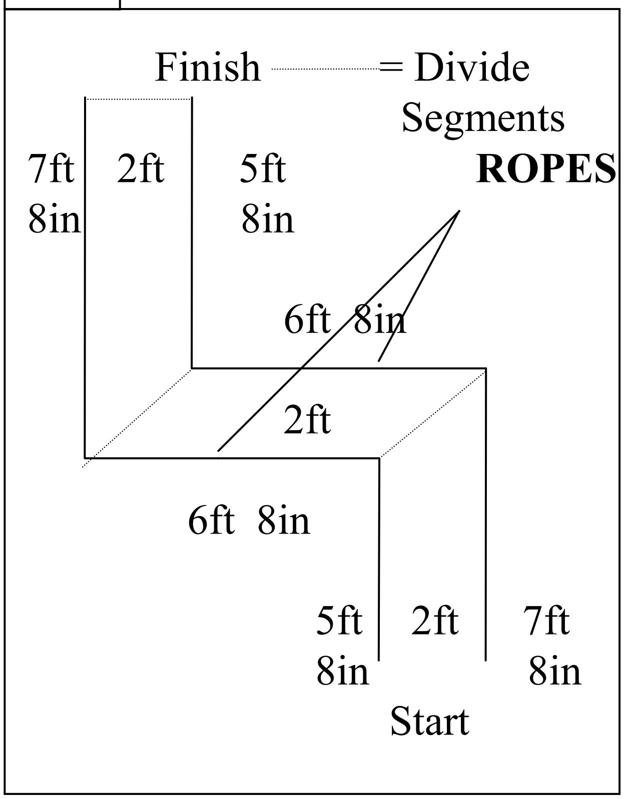
PART A:

1. Lay down a driving course with the ropes as seen in Fig. 1.
2. Have a partner stand between corners 1 and 2 equipped with a chronograph.
3. Start the car down the track at a constant power consumption (don't manipulate the controls except when turning the corners)
4. As the car passes each corner and the finish line, have the partner mark the time elapsed since the car's start Also mark the mass of the car with the triple-beam balance.
5. Record the times and calculate speed, velocity, acceleration, and momentum of the car at each corner and at the finish (for corner 1: Speed = 6ft/time; Velocity = Dist/Time; Acceleration = velocity/time; Momentum = velocity x mass of car; etc.).

PART B:

1. Using the same ropes as in part A, lay out a straight course, and have a partner stand at 1/3, 2/3, and at the finish of the track. Proceed as in Part A starting from step 4.

FIG. 1



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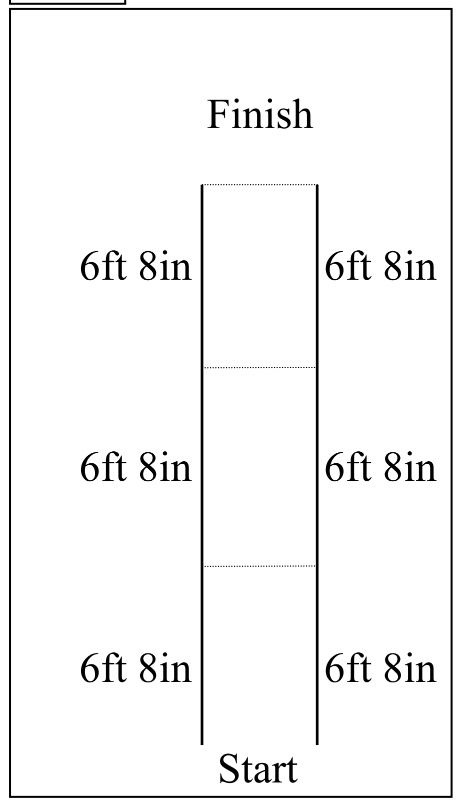

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Finish	175kg	1.28sec	6ft	4.68ft/sec	0.78ft/sec2	819N	Straight course
Formulas	N/A	N/A	N/A	Dist/Time	V2-V1/Time	Vel x Mass	N/A

Car Data/Observations: Part B

at	Mass (kg)	Time (sec)	Distance (ft)	Velocity (ft/sec)	Acceleration (ft/sec2)	Momentum (ft/sec x kg)	Observations
Start	175	0.00	0ft	N/A	N/A	N/A	Not moving
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Formulas	N/A	N/A	N/A	Dist/Time	V2-V1/Time	Vel x Mass	N/A

Discussion/Results:

In this lab, a remote-controlled car was timed as it moved at a constant power consumption down two different courses to determine the effects of turning on the velocity, acceleration, and momentum of the car. One course had two turns, the other was straight. The mass of the car was recorded. As the car was driven down the track, the time and distance traveled were recorded at equidistant points. In Part A, when the car rounded the first corner, it decelerated and slid slightly, almost spinning out. At that point the control of the car was difficult. The data in Part A was in itself unenlightening; however, it was helpful when compared to data in Part B.

In Part B, the car continued to accelerate from the start to the finish, as expected. At each point, the car had more velocity, acceleration, and momentum in Part B than in Part A. This shows that the car lost momentum as it turned each corner in Part A. This agrees with the Law of Conservation of Momentum, which states that momentum can be transferred but not destroyed. In Part A, some of the car's momentum was transferred to the ground in the form of friction.

There is room for error in this experiment, from differing reactions of the controller to human error in timing to slightly less powerful batteries, each of which could have slightly altered the results. To minimize such errors, multiple tests were run, and the results were averaged.

Conclusion:

After reviewing the results of this experiment, it is concluded that, as stated in the hypothesis, velocity, acceleration, and momentum are lost as an object turns a corner.