SAINT JOSEPH'S PREPARATORY SCHOOL
Physics Lab - Conservation of Momentum

Two dynamics carts at rest on the table have zero momentum. If they are arranged so that they can be forced apart by releasing a spring compressed between them, the momentum of each will change but the total momentum will remain zero.

This experiment is designed to find evidence to support the Law of Conservation of Linear Momentum. This will be done indirectly in order to eliminate the need for measuring time or velocity. It remains necessary to measure mass and distance.

Equipment and Materials:

1. 2" x 4" x 4' boards clamped to the lab table correctly.
2. Dynamics cart without plunger.
3. Dynamics cart with plunger.
4. meter sticks.
5. bricks.
6. masking tape
7. balances with supplemental weights.

Procedure:

1. Measure the mass of each dynamics cart and each brick. Do not mark the carts and mark the bricks only with a small piece of masking tape.
2. Make certain that the 2 x 4's are parallel and 2.0 m apart.
3. Make certain that the spring trigger works properly.
4. Make note of the masses of the two carts.
5. Position the carts so that they will go in opposite directions and hit the 2 x 4's when the spring is released. The carts should be touching each other.
6. By trial and error, find the location of the two carts that results in them hitting the boards simultaneously. Record the distance each travels before hitting the boards.
7. Reverse the directions of the two carts and repeat the trial.
8. Load the carts with different combinations of bricks making careful note of the total mass traveling in each direction. Repeat the measurements for each combination. **Make sure that each combination of bricks is run in both directions**.
9. The experiment must be run for at least four different combinations of bricks and carts. **Fill in the data table completely**.

Analysis:

The reason for running each trial in both directions is to compensate for the significant effects of gravity on the no longer level lab tables. By averaging the distances a cart travels in opposite directions, the acceleration due to gravity caused by the tilt of the table will be partially eliminated

The total momentum after the spring acts should be zero if the two carts were not moving before the spring was released. By placing the momenta on opposite sides of the equal sign, the need for one of them to be negative is eliminated.

$$m_1\mathbf{v}_1 = m_2\mathbf{v}_2$$

$$\mathbf{v}_1 = \frac{\mathbf{x}_1}{t_1}; \mathbf{v}_2 = \frac{\mathbf{x}_2}{t_2}$$

$$m_1\frac{\mathbf{x}_1}{t_1} = m_2\frac{\mathbf{x}_2}{t_2}$$

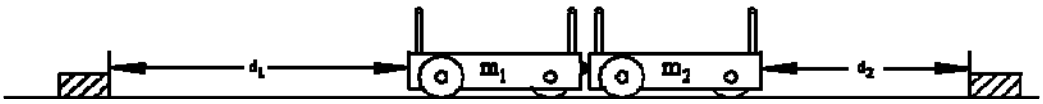
$$t_1 = t_2$$

$$\therefore m_1\mathbf{x}_1 = m_2\mathbf{x}_2$$

As can be seen in these equations, if care is taken to ensure that the two carts hit at exactly the same time, the comparison between the momenta can be accomplished by using the products of mass and distance. After the product is found for each cart, it is necessary to determine the percent difference between the two values using the smaller value as the base.

Conclusions:

If you believe that your data suggest that linear momentum is conserved, explain why. If your data do not support the Law of Conservation of Momentum, explain what leads you to this conclusion and list some reasons why the experiment might have lacked accuracy.



DATA

Item	Number	Mass
Cart with plunger [A]		
Carth without plunger [B]		
First brick [1]		
Second Brick [2]		

Trial				Distance left	Distance right	Average Distance
1	Cart [A]	Brick(s) on [A]	Total mass [A]			
	Cart [B]	Brick(s) on [B]	Total mass [B]			
2	Cart [A]	Brick(s) on [A]	Total mass [A]			
	Cart [B]	Brick(s) on [B]	Total mass [B]			
3	Cart [A]	Brick(s) on [A]	Total mass [A]			
	Cart [B]	Brick(s) on [B]	Total mass [B]			
4	Cart [A]	Brick(s) on [A]	Total mass [A]			
	Cart [B]	Brick(s) on [B]	Total mass [B]			