

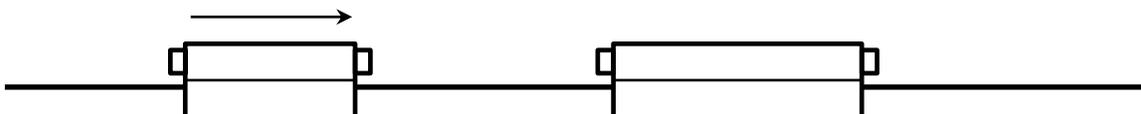


Law of Conservation of Momentum

Lab #18

Pre-Lab Discussion

The Law of Conservation of Momentum states that the total momentum is a constant or, in equation form, $p_{\text{before}} = p_{\text{after}}$. We will use a timing app on a tablet, two carts, and an air track to attempt to confirm this law.



Research Question

How can the Law of Conservation of Momentum be confirmed using carts and an air track?

Materials

air track
balance

two air track carts (bumper)

tablet app

Method

1. Determine the masses of the two air carts m_{C1} and m_{C2} and record the data in the data table.
2. Place cart₂ in the air track and level the track (the cart should remain still).
3. Start the timing app on the tablet.
4. Place cart₁ at one end of the track and give it a gentle push. (It should take at least one second to hit cart₂.)
5. After the carts collide, let the app gather data until one cart hits the end of the track.
6. Analyze the app data to determine the times and distances each cart travels before and after the collision. Record $t_{1 \text{ before}}$, $t_{2 \text{ before}}$, $t_{1 \text{ after}}$, $t_{2 \text{ after}}$, $d_{1 \text{ before}}$, $d_{2 \text{ before}}$, $d_{1 \text{ after}}$, and $d_{2 \text{ after}}$.
7. Carefully return all equipment before doing data processing and conclusions.

Data Collection and Processing

Data

Data Table				
m_{C1} (g)	$t_{1 \text{ before}}$ (s)	$t_{1 \text{ after}}$ (s)	$d_{1 \text{ before}}$ (m)	$d_{1 \text{ after}}$ (m)
m_{C2} (g)	$t_{2 \text{ before}}$ (s)	$t_{2 \text{ after}}$ (s)	$d_{2 \text{ before}}$ (m)	$d_{2 \text{ after}}$ (m)

Calculations (show all equations, substitutions with units, and results)

1. Find the speed of $Cart_1$ before the collision. (Show results for v_1 after, v_2 before, and v_2 after in the results table.)

$$v_1 \text{ before} =$$

2. Find the momentum of Cart1 before the collision. (Show results for p_1 after, p_2 before, and p_2 after in the results table.)

$$p_1 \text{ before} =$$

3. Find the total change in momentum for both carts.

$$\Delta p =$$

Results

Results Table				
Cart ₁	v_1 before (m/s)	v_1 after (m/s)	p_1 before (N·s)	p_1 after (N·s)
Cart ₂	v_2 before (m/s)	v_2 after (m/s)	p_2 before (N·s)	p_2 after (N·s)

Conclusions

1. Was momentum *reasonably* conserved in this experiment?

2. What are some sources of error in this experiment?

3. Define these terms: elastic collision and inelastic collision.

Applications

1. What did YOU (personally) learn?

2. How can any idea, principle, or activity in this lab be used in the real world?
