

# Conservation of Momentum

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## Abstract

The purpose of this lab is to study conservation of momentum and the differences between elastic and inelastic collisions. This lab focuses on collisions in a one-dimensional system with two objects. By sliding two gliders with known masses toward each other on an air track and calculating the total momentum of the system ( $p$ ) and after ( $p'$ ) the collision, we see that, because  $p = p'$ , momentum is conserved.

## Introduction

## Apparatus

- Air track
- Two gliders
- Two photo gates
- Computer with timing and analysis software

## Procedure

The air track and compressor were set up by the lab instructors prior to our experiment. We ensured that the track was level by adjusting the base support screws until a glider in the middle of the track remained stationary. We then placed a photogate 30 cm from each end of the track and placed a rubber band bumper on each end of the track, to prevent the gliders from colliding harshly into the ends of the track after colliding with one another.

## Data

### Glider Masses

Trial	$m_1$	$m_2$
1	191.19g	191.81g
2	312.70g	191.81g
3	191.19g	191.81g
4	312.70g	191.81g

# Calculations and Graphs

## Inelastic Collisions

Momentum – Inelastic

Trial	$p$	$p'$	% Diff.	Av. % Diff.
1	0.149	0.092	47.3	24.9
1	0.113	0.100	12.2	
1	0.134	0.115	15.3	
2	0.172	0.166	3.6	10.8
2	0.188	0.187	0.5	
2	0.181	0.136	28.4	

Kinetic Energy – Inelastic

Trial	$KE$	$KE'$	% Diff.	Av. % Diff.
1	0.058	0.011	136.2	106.6
1	0.033	0.013	89.9	
1	0.047	0.017	93.8	
2	0.047	0.027	54.1	66.3
2	0.056	0.035	46.2	
2	0.053	0.018	98.5	

## Elastic Collisions

Momentum – Elastic

Trial	$p$	$p'$	% Diff.	Av. % Diff.
3	0.098	0.063	43.5	32.6
3	0.099	0.077	25.0	
3	0.098	0.073	29.2	
4	0.159	0.092	53.4	60.4
4	0.169	0.090	61.0	
4	0.200	0.100	66.7	

Kinetic Energy – Elastic

Trial	$KE$	$KE'$	% Diff.	Av. % Diff.
3	0.049	0.032	41.9	33.2
3	0.050	0.038	27.2	
3	0.049	0.036	30.5	
4	0.041	0.025	48.5	48.6
4	0.046	0.028	48.6	
4	0.064	0.039	48.5	

## Discussion of Results and Error Analysis

## Conclusion