

Lab 4 – Write-Up Guidelines

Experiment A: Perfectly Inelastic Collisions

Methods

1. Draw diagrams for the carts before and after the collision (from A5) with labels on the velocity vectors for every object in your drawing.
2. Derive v_{final} in terms of m_{large} , m_{small} , v_0 .

Data

1. Masses of the gliders, lengths of the flags, and photogate time differences (i.e. data from the top half of the example table shown in A8), for all three initial velocity trials.

Results & Analysis

1. Derive “once” the error propagation for
 - o velocity in terms of flag length and time difference
 - o initial momentum
 - o final momentum
 - o initial kinetic energy
 - o final kinetic energy
 - o You can re-use these expressions for error propagation later.
2. Table with experimental values for all these quantities with uncertainty differences
3. MATLAB curve fit and parameters to v_{final} vs. v_0 data.
4. Conclude if your data was consistent with the hypothesis that you were observing a perfectly inelastic collision (hint: using the slope). If not, discuss what may have caused a deviation.
5. Conclude if momentum was conserved during the collision (hint: using the slope and y-intercept). If not, you have two possible options: (1) Momentum is not conserved when two objects collide (Newton’s laws were observed to be invalid), or (2) There were unaccounted-for systematic errors. Discuss your belief in these two possibilities, in particular how you could have accounted for (2).

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Experiment B: Elastic Collisions

Methods

1. The two diagrams of before and after the collision from B1 with labels of the velocity vectors for every object in your drawing.

Data

1. Masses, lengths, and time differences for three mass ratio trials described in B4.

Results & Analysis

1. Velocity, momentum, and energy values for all three mass ratio trials. Again, you may reuse the expressions derived for these quantities and their uncertainties from Experiment A.
2. Calculate Δp and ΔKE , and their uncertainties, for each trial separately.
3. Conclude if momentum and kinetic energy were conserved during these collisions, and whether your results matched with expectations. If they didn't match expectations, discuss sources of error and how they could be accounted for *quantitatively*.