Introduction

For any collision occuring in an isolated system, momentum is conserved. The total amount of momentum of the collection of objects in the system is the same before the collision as after the collision. A common physics lab involves the dropping of a book upon a cart in motion. The dropped book is at rest and begins with zero momentum. The loaded cart is in motion with considerable momentum. This momentum can be calculated using the velocity of the cart and it's mass. The total amount of momentum is the sum of the dropped book's momentum and the loaded cart's momentum. After the collision, the momenta of the two seperate objects can be determined from their measured mass and their velocity. If the momentum is conserved during the collision, the sum of the dropped book's and loaded cart's momentum after the collision should be the same as before the collision. The momentum lost by the loaded cart should equal the momentum gained by the dropped book.

Purpose

To test the law of Conservation of Momentum.

Materials

- cart
- book
- spark timer
- graph paper

Procedure

1) In pairs, collect the required materials
2) weigh the cart in grams, convert to kg.
3) Weigh the book in grams, convert to kg.
4) Set-up spark time (60 Hz), attach to the cart.
5) Propel the cart along a smooth surface (the floor).
6) Standing completely perpendicular to the cart, drop the book directly down onto the moving cart
   * make sure that you are NOT adding any forward or sideward force as this will skew the results *
7) Collect and analyze the ticker tape - ensure that it shows two distinct periods of constant velocity - before the book was added and after (indicated by even placement of dots).
8) Record the time-position data for ~15 dots on either side of the impact point
9) Construct a position-time graph and draw two best-fit lines. Calculate the velocities.

Table 1: Position time data

Time: T(s)	Position: X(m)	Time: T(s)	Position: X(m)
0		16/60	
1/60		17/60	
2/60		18/60	
3/60		19/60	
4/60		20/60	
5/60		21/60	
6/60		22/60	
7/60		23/60	
8/60		24/60	
9/60		25/60	
10/60		26/60	
11/60		27/60	
12/60		28/60	
13/60		29/60	
14/60		30/60	
15/60			