PST COLLISION LAB

EQUIPMENT NEEDED:

- ✓ **Two carts with hook and pile (Velcro) tabs (each have a mass of 500g).**
- ✓ **Two carts with magnetic bumpers (each have a mass of 500g)**
- ✓ **Extra mass for the carts (each has a mass of 500g)**
- ✓ **Dynamics Cart Track**
- ✓ **Masking Tape**
- ✓ **Index Cards**
- ✓ **A laptop, LabPro, and motion sensor.**

PURPOSE

The purpose of this experiment is to qualitatively explore conservation of momentum for elastic and inelastic collisions.

PROCEDURE

1. Level the track using the builder's level provided. Adjust the leveling feet at the end of the track to raise or lower that end of the track. A cart placed at rest on a level track will not move.

2. Do ALL of the following steps for each "Case" listed below in the order shown:
   a. Draw a diagram showing each cart (one diagram will show both carts moving before the collision and one will show both carts moving after the collision).
   b. Draw an arrow ABOVE each of your carts representing the velocity that each of your carts in your diagram will have before the collision. Make your arrow longer for large velocities, and shorter for small velocities. DO THIS BEFORE YOU COLLIDE THE CARTS!
   c. Draw an arrow BELOW each of your carts representing the velocity that each of your carts in your diagram will have AFTER the collision. If you think one of the carts will have half the speed of one of your initial velocities, draw your arrow half as long. DO THIS BEFORE YOU COLLIDE THE CARTS.
   d. Collide your carts and observe the collision. Use two motion sensors and a laptop to record the velocities of both carts before and after the collision. You will need to look on the graph on the computer to determine these velocities.
   e. Calculate the momentum of both carts before and after the collision (you will have four calculations for each "Case". Place each cart's momentum BEFORE the collision ABOVE the carts on your diagram. Place each of the cart's momentum AFTER the collision BELOW the carts on your diagram.
   f. Compare the total momentum of both carts added together before the collision with the total collision of both carts added together after the collision. Are they the same?

Part I : Elastic Collisions -- Using carts with magnetic bumpers.

A. Carts with Equal Mass

Orient the two carts so their magnetic bumpers are toward each other.

Case 1: Place one cart at rest in the middle of the track. Give the other cart an initial velocity toward the cart at rest.

Case 2: Start the carts with one at each end of the track. Give each cart approximately the same velocity toward each other.

Case 3: Start both carts at one end of the track. Give the first cart a slow velocity and the second cart a faster velocity so that the second cart catches the first cart.

B. Carts with Unequal Mass

Put two mass bars in one of the carts so that the mass of one cart is approximately three times the mass (3M) of the other cart (1M).

Case 4: Place the 3M-cart at rest in the middle of the track. Give the other cart an initial velocity toward the cart at rest.

Case 5: Place the 1M-cart at rest in the middle of the track. Give the 3M-cart an initial velocity toward the cart at rest.

Case 6: Start the carts with one at each end of the track. Give each cart approximately the same velocity toward each other.

Case 7 & 8: Start both carts at one end of the track. Give the first cart a slow velocity and the second cart a faster velocity so that the second cart catches the first cart. Do this for both cases: with the 1M-cart first and then with the 3M-cart first.

Part II : Completely Inelastic Collisions – Carts having Velcro

3. Orient the two carts so their hook-and-pile ends are toward each other. Make sure the plunger bar is pushed in completely so it won't interfere with the collision. Repeat the same procedures listed in **Part 1** for carts with equal mass **and** carts with unequal mass.