Main Topic	Motion
Subtopic	Momentum
Learning Level	Middle
Technology Level	Low
Activity Type	Student

Description: Investigate the momentum imparted during elastic and inelastic collisions.

Required Equipment	Bouncing Dart, Dynamics Cart, 2 Ring Stands, Meter stick
Optional Equipment	

Educational Objectives

- To investigate the momentum imparted during elastic and inelastic collisions.

Concept Overview

If you fell from a tree limb onto a trampoline, you'd bounce. If you fell into a large pile of leaves, you'd come to rest without bouncing. In which case, if either, is the change in your momentum greater? This activity will help answer that question. Students will compare the changes in momentum in the collision of a "bouncing dart" in cases where bouncing does take place and where it doesn't.

Originally developed for Paul Hewitt's Conceptual Physics, the Bouncing Dart demonstrates the energy transfer that occurs in elastic and inelastic collisions. The dart has an elastic end and an inelastic end. Swing the dart so that it collides with a massive (1kg or more) dynamics cart, and compare the distances the cart moves when hit by the different ends.

Lab Tips

Bricks or other weights may be set on the ringstand bases, to prevent tipping.

Bouncing Dart

Name: _____

Class: _____

Goal:

Investigate the momentum imparted during elastic and inelastic collisions.

Materials:

Bouncing Dart, Dynamics Cart, 2 Ring Stands, Meter stick

Procedure:

1. Bounce each of the two ends of the dart on the table, and determine which is elastic and which is inelastic.
2. Attach the dart to the ring stands, using the two clamps, so that it swings as a pendulum. Adjust the height so that the dart strikes the middle of one end of the dynamics cart when the dart is at the lowest point of its swing. Make sure the ring stand is secure and will not tip when the pendulum swings.
3. First, use the inelastic end of the dart. Position the dynamics cart so it has room to roll on a level table or floor after being struck.
4. Experiment to find out how high you need to lift the pendulum in order to make the cart roll about a foot. Record the vertical distance you lift the pendulum: _____
5. Repeat the collision several times, lifting each time to the same vertical distance. Find the average distance that the cart rolls after the collision.

6. Repeat using the elastic end of the dart. Be sure to use the same vertical release distance as before. Find the average distance that the cart rolls after the collision.

7. What do you observe about the two types of collisions?

8. The dart has positive momentum while it is swinging toward the cart. After the dart bounces off of the cart, is the dart's momentum positive or negative?

9. When does the dart undergo the greater change in momentum – when it bounces off the cart, or when it doesn't?

10. When does the cart undergo the greatest change in momentum – when struck by the elastic or inelastic end of the dart? Explain.

11. How do the stopping distances of the carts compare?

12. How do you explain the difference in stopping distances?