LAB 7
Collisions

OBJECTIVES

(1) Investigate how the velocity of an object changes after undergoing a completely inelastic collision and an elastic collision.
(2) Come up with a viable theory that describes how the velocity of an object will change after a completely inelastic collision and after an elastic collision.

EQUIPMENT

Dynamics carts and Capstone software.

PROCEDURE

Part 1: Completely Inelastic Collisions

(1) Set up the Capstone software to measure the velocity of each dynamics cart as a function of time as demonstrated by the instructor.

(2) Arrange the carts so that the Velcro sides are facing each other and the carts will stick together after they collide.

(3) For each of the following three different cases, you are going to have a moving cart (m_1) collide with a cart that is at rest (m_2).

Case (1) $m_1 = m_2$ with $v_1 \neq 0$ and $v_2 = 0$
Case (2) $m_1 = 3m_2$ with $v_1 \neq 0$ and $v_2 = 0$
Case (3) $m_1 = \frac{1}{3} m_2$ with $v_1 \neq 0$ and $v_2 = 0$

(4) Before you run each experiment, **first make a prediction.** Then run the experiment and answer the follow-up questions:

Prediction:

Do you think the final velocity of the two carts after the collision will be greater than, less than, or equal to the initial velocity of cart 1?

Note: *if you think the final velocity will be different than the initial velocity, by what factor do you think it will change? (i.e. the final velocity will increase/decrease by a factor of X)*

Follow-up Questions:

What was the initial velocity of the moving cart (cart 1)?

What was the final velocity of the two carts after the collision?

Was the final velocity greater than, less than, or equal to the initial velocity of the moving cart? If it was greater than or less than, by what factor?

(4) As a group, try and come up with a viable theory for how the velocity of the two carts after the collision will compare with the initial velocity of the moving cart before the collision.

What theory did your group come up with?

Part 2: Elastic Collisions

(5) Now arrange the carts so that the magnets are facing each other and the carts will bounce off of each other without touching.

(6) For each of the following three different cases, you are going to have a moving cart (m_1) collide with a cart that is at rest (m_2).

Case (1) $m_1 = m_2$ with $v_1 \neq 0$ and $v_2 = 0$
Case (2) $m_1 = 3m_2$ with $v_1 \neq 0$ and $v_2 = 0$
Case (3) $m_1 = \frac{1}{3} m_2$ with $v_1 \neq 0$ and $v_2 = 0$

(7) Before you run each experiment, **first** make a prediction. Then run the experiment and answer the follow-up questions:

Prediction:

*What do you think will happen to **each** cart after the collision?*

*(**Note**: The possibilities are: come to rest, move forward with a smaller velocity, move forward with a greater velocity, move backward with a smaller velocity, or move backward with a greater velocity)*

Follow-up Questions:

What actually happened to each cart after the collision?

(8) As a group, try and come up with a viable theory for how the velocity of the two carts after the collision will compare with the initial velocity of the moving cart.

What theory did your group come up with?