Conservation of Momentum Names: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Objective:** Determine if kinetic energy and momentum are conserved in elastic and inelastic collisions.

**Prelab Questions:**

1. What is an elastic collision and what is an inelastic collision?

2. What are the equations for calculating kinetic energy and momentum?

3. What does it mean for a quantity to be conserved? For example, what does it mean when we say energy is conserved?

4. Suppose you have two carts, one is heavier than the other, but they have the same momentum. Can they have different kinetic energies? Either provide an example (with numbers) to show that they could have the same momentum and different kinetic energies, or use the equations for momentum and kinetic energy to prove that if momentum is the same then kinetic energy must always be the same.

**Procedure:**

Write 1 procedure to explain how you will measure mass and velocity of carts during a collision using motion encoders. You do not need to write separate procedures for each collision.

Draw 1 sketch showing what setup looks like. You do not need to draw separate sketches for each collision.

Below are the 5 collisions you will measure.

**Elastic Collisions – use 2 encoder carts.**

A. The first cart hits a second stationary cart that is more massive than the first.

B. The first cart hits a second stationary cart that is equally massive as the first.

C. The first cart hits a second stationary cart that is less massive than the first.

**Inelastic Collisions – use 1 encoder cart and 1 plain cart.**

D. The first cart hits a second stationary cart that is more massive than the first.

E. The first cart hits a second stationary cart that is less massive as the first.

**Data:**

Create data tables to record masses and velocities before and after each collision.

Clearly label which collision each data set goes with.

**Analysis:**

Calculate the total momentum before and total momentum after each collision.

*Remember that momentum is a vector so a cart can have negative momentum.*

Calculate the total kinetic energy before and after each collision.

*Remember that kinetic energy is not a vector so a cart can’t have negative kinetic energy.*

Calculate a percent difference for momentum before and after and kinetic energy before and after.

*A percent difference less than 10% means that the values are close to the same.*

Organize these calculations in a table that clearly indicates the type of collision each value goes with.

Feel free to use a spreadsheet to make these calculations easier.

**Conclusion**

1. Which type(s) of collisions conserve momentum?

2. Which type(s) of collisions conserve kinetic energy?

3. Explain where impulse is present during a collision.

4. Would the impulse delivered during a collision be greater in an elastic or inelastic collision. Explain

5. Which type of collision would be less dangerous for passengers riding inside a car? Explain