

Name _____

Impulse and Momentum Lab

Directions: In this lab you will use crash carts to analyze the change in momentum during elastic and inelastic collisions. Follow the instructions below.

Materials

- crash cart
- measuring tape
- masking tape
- stopwatch

Procedure: Impulse and Change in Momentum

- Measure out a distance of 7 meters using the measuring tape
- Have (1) member of the group sit on the crash cart
- Have a second member at the finish line to apply an impulse to stop the cart
- Begin from behind the start line and push the cart and release the cart at the start line.
- Have one group member begin timing when the cart is at the start line and stop timing when it strikes the group member at the finish line.
- Have a second group member record the time it takes to stop the cart
- Record the distance cart travels, calculate the velocity of the cart before the collision, calculate the mass of cart/rider, calculate the force required to stop the cart and place this information in the table
- Repeat the experiment 2 times changing riders
- Answer the questions that follow

Experiment	Mass of Cart 1	Cart travel Time (start to Finish)	Velocity of Cart 1 before collision	Momentum of Cart 1 before collision	Time to stop the cart	Force required to stop cart
Trial 1						
Trial 2						
Trial 3						

Show all calculations below

Velocity of cart before collision	Momentum of cart before collision	Force Required to stop cart
#1		
#2		
#3		

1. Define momentum. Give the equation and unit.

2. Two cars, one twice as heavy as the other, move down a hill at the same speed. Compared to that of the lighter car, the momentum of the heavier car is _____ as much.

3. a. For a constant force, if the duration of impact upon an object is doubled, how is the impulse affected?

b. How is the resulting change in momentum affected?

4. If the time of impact in a collision is extended by four times, by how much is the force of impact altered?

5. Define impulse. Give its equation and unit.

Use the impulse-momentum equation to answer questions 6-9:

6. Why is it important to "follow through" when trying to hit a home run?

7. Why does it hurt more when you fall on a concrete floor than on a wooden floor?

8. Why are car dashboards, steering wheels, and boxing gloves padded?

9. How can a karate "chop" break a board?

10. What is the momentum of a golf ball with a mass of 62 g moving at 73 m/s?

11. If in the problem above, the impact between the ball and club lasted for 2.0×10^{-3} s, what force acted on the ball? What force acted on the club?

12. For how long a time must a tow truck pull with a force of 550 N on a stalled 1200 kg car to give it a forward velocity of 2.0 m/s?