ICP Lab: Conservation of Momentum Name:

PURPOSE: To study and verify the law of conservation of momentum in colliding objects

MATERIALS:

- two Vernier frictionless carts
- triple beam balance
- meter stick
- 4 stopwatches per group
- masking tape

PROCEDURE:

Part A: Collision of a moving object with a stationary object (equal mass non-sticking)

1) Label both of your carts "A" and "B" using the masking tape
2) Place a piece of masking tape at the 80 cm mark
3) Using the triple beam balance, measure the masses of both carts with the masking tape on them and record this on your data table.
4) Place cart A so that its forward side is at the 50 cm mark on the track. Place cart B at the end of the track. Measure the distance between the forward side of cart B and the rearward side of cart B. *Make sure that the magnetic sides are facing each cart*. Record this on your data table.
5) Have timers ready. The first timer will measure the time it takes for cart B to hit cart A. The second timer will measure the time that it takes for cart A to reach the 80 cm mark. When timers are ready, one person will push cart B so that it will hit cart A.
6) Repeat steps A1 through A5 four more times

OBSERVATIONS/ANALYSIS:

Part A: Collision of a moving object with a stationary object (equal mass non-sticking)

Mass of Cart A: _____ Mass of Cart B: _____

Trial	Distance from Cart B to Cart A (initial)	Time taken for B to hit Cart A	Average speed of Cart B	Time taken for cart A to pass 80 cm	Average speed of Cart A 30cm
1					
2					
3					
4					
5					

Calculations for PART A (Part A: Collision of a moving object with a stationary object (equal mass non-sticking)

Trial	Momentum of Cart A (initial)	Momentum of B (initial)	Total momentum of BOTH Carts Initial	Momentum of Cart A (final)	Momentum of Cart B (final)	Total momentum of BOTH carts final	Ratio of initial to final momentum
1							
2							
3							
4							
5							

SAMPLE CALCULATIONS:

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PROCEDURE:

Part B: Collision of a moving object with a stationary object (equal mass sticking)

1) Place cart A so that its forward side is at the 50 cm mark
2) Put cart B at the end of the track and re-verify the distance between the forward part of cart B and the rearward side of cart A. *Make sure the Velcro sides of the carts are facing each other*.
3) Have timers ready. The first timer will measure the time it takes for cart B to hit cart A. The second timer will measure the time it takes for the front of carts A and B to pass the 80 cm mark.
4) Repeat steps B1 through B3 four more times

OBSERVATIONS/ANALYSIS:

Part B: Collision of a moving object with a stationary object (equal mass sticking)

Mass of Cart A: _____ Mass of Cart B: _____ Mass of A & B: _____

Trial	Distance from Cart B to Cart A (initial)	Time taken for B to hit Cart A	Average speed of Cart B	Time taken for cart A to pass 80 cm	Average speed of Cart A 30cm
1					
2					
3					
4					
5					

Part B: Collision of a moving object with a stationary object (equal mass sticking)

Calculations:

Trial	Momentum of Cart A (initial)	Momentum of B (initial)	Total momentum of BOTH Carts Initial	Momentum of Cart A (final)	Momentum of Cart B (final)	Total momentum of BOTH carts final	Ratio of initial to final momentum
1							
2							
3							
4							
5							

SAMPLE CALCULATIONS:

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PROCEDURE:

Part C: Collision of a moving object with a stationary object (non-equal mass sticking)

1) Place cart A so that its forward side is at the 50 cm mark. Place one of the 0.500 kg masses on the back of cart A.
2) Put cart B at the end of the track and re-verify the distance between the forward part of cart B and the rearward side of cart A. *Make sure the Velcro sides of the carts are facing each other*.
3) Have timers ready. The first timer will measure the time it takes for cart B to hit cart A. The second timer will measure the time it takes for the front of carts A and B to pass the 80 cm mark.
4) Repeat steps C1 through C3 four more times

OBSERVATIONS/ANALYSIS:

Part C: Collision of a moving object with a stationary object (non-equal mass sticking)

Mass of Cart A: _____ Mass of Cart B: _____ Mass of A & B: _____

Trial	Distance from Cart B to Cart A (initial)	Time taken for B to hit Cart A	Average speed of Cart B	Time taken for cart A to pass 80 cm	Average speed of Cart A 30cm
1					
2					
3					
4					
5					

Calculations: Part C: Collision of a moving object with a stationary object (non-equal mass sticking)

Trial	Momentum of Cart A (initial)	Momentum of B (initial)	Total momentum of BOTH Carts Initial	Momentum of Cart A (final)	Momentum of Cart B (final)	Total momentum of BOTH carts final	Ratio of initial to final momentum
1							
2							
3							
4							
5							

SAMPLE CALCULATIONS:

Summary Questions:

1. Define Momentum.

2. What formula do you use to calculate the momentum of an object?

3. Ideally, what should be the ratio of momentum after to momentum before?

4. Calculate the percent error in ONE of EACH of your experiments.

5. What are some potential sources of error in this experiment?