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PH114-08

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Conservation of Momentum

Statement of Purpose:

Our group will observe the state of momentum in two objects during both elastic and inelastic collisions and determine how the law of conservation of momentum applies to their system.

Introduction:

Our group used a contraption consisting of a horizontal track, carts and photogates. Each cart was placed at one end of the track and pushed toward the other. Before the two collide in the middle their initial speed is measured by the photogates. The two carts collide and bounce apart, with their final velocities measured again by the photogate. This allows our group to see that the momentum is conserved during the collision, but when the experiment is run again with velcro to keep the carts from bouncing, momentum is not conserved in the system.

Equipment:

Track, cart, pickets, photogates, datastudio, velcro.

Procedure:

1. Turn on the computer and open Datastudio
2. Level the track
3. Place a picket on each cart
4. Measure the mass of each cart plus its picket
5. Place each cart at opposite ends of the track
6. Set up photogates between the middle of the track and each cart
7. roll the carts toward each other, velcro sides facing away
8. repeat 7 until the carts bounce between the photogates and then travel back past the photogates, providing all of the speed information
9. Place one cart in the middle and one on an edge
10. Roll the edge cart toward the middle cart so that they are not velcroed
11. Use the photogates to determine the initial and final speed of each cart
12. Place each cart at opposite ends again
13. Roll them toward each other so that they will be velcroed on impact
14. Record initial and final speeds

Data:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Elastic,  Both towards | V1 initial  (m/s) | V2 initial  (m/s) | V1 final  (m/s) | V2 final  (m/s) |
| Run 1 | 0.33 | 0.27 | 0.22 | 0.30 |
| Run 2 | 0.39 | 0.36 | 0.30 | 0.34 |
| Run 3 | 0.48 | 0.46 | 0.36 | 0.39 |
| Elastic,  One at rest |  |  |  |  |
| Run 1 | 0.32 | 0 | 0 | 0.30 |
| Run 2 | 0.40 | 0 | 0 | 0.38 |
| Run 3 | 0.49 | 0 | 0 | 0.47 |
| Inelastic,  One at rest |  |  |  |  |
| Run 1 | 0.41 | 0 | 0.16 | 0.16 |
| Run 2 | 0.38 | 0 | 0.13 | 0.13 |
| Run 3 | 0.44 | 0 | 0.17 | 0.17 |

Mass1 = 0.504kg Mass2 = 0.504kg

Elastic, both towards:

Elastic, one at rest:

Inelastic, one at rest:

Analysis:

The data we collected during the experiment shows the relationship between the momentum of bodies before and after collisions. Going into the experiment we expected to see the data conform to the law of Conservation of Energy, which states that during elastic collisions momentum is conserver, or retained, and that during inelastic collisions momentum may be lost. From the first two sections of the experiment which deal with elastic collisions, we can see that the before and after scenarios are very similar, with small losses that may be attributed to friction and track setup. Our third section dealt with inelastic collisions, and the margin between the momentum of the system before and after is larger. All three of our test indicate the presence of the conservation of momentum law, showing that when the collision does not involved lodged objects, momentum between the involved bodies does not change.

Conclusion:

In our experiment we discovered the relation between initial and final momentums of objects during elastic and inelastic collisions. Our group saw that during an elastic collision where the two bodies collide and then separate, momentum is conserved throughout. Likewise, we saw a larger decrease in momentum during elastic collisions, which supports that the momentum is not conserved in inelastic collisions.