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PH 1110 – Lab – 5: Conversation

1. Velocity vs Time of Collision with Plunger Extended

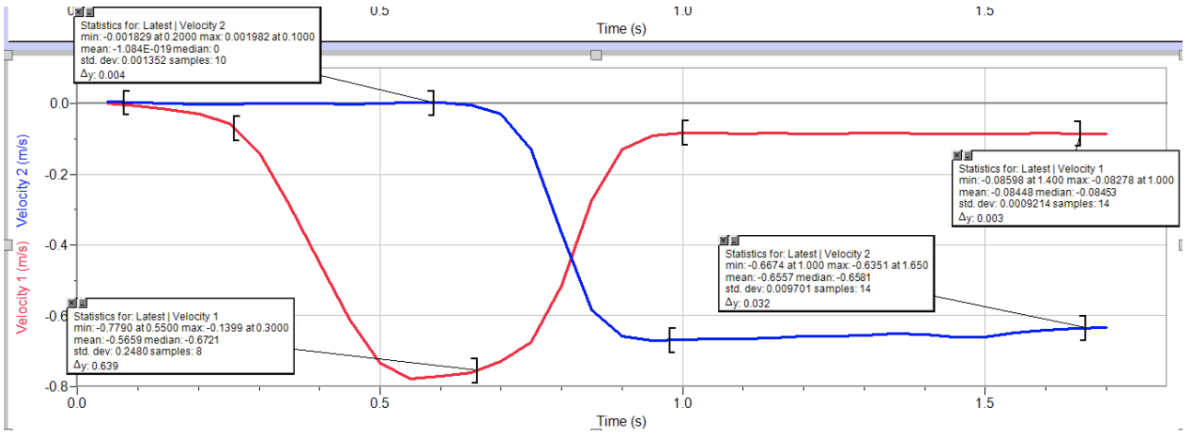

Figure: 1 – Velocity vs Time – Plunger Extended

2. Velocity vs Time of Collision with Plunger Extended

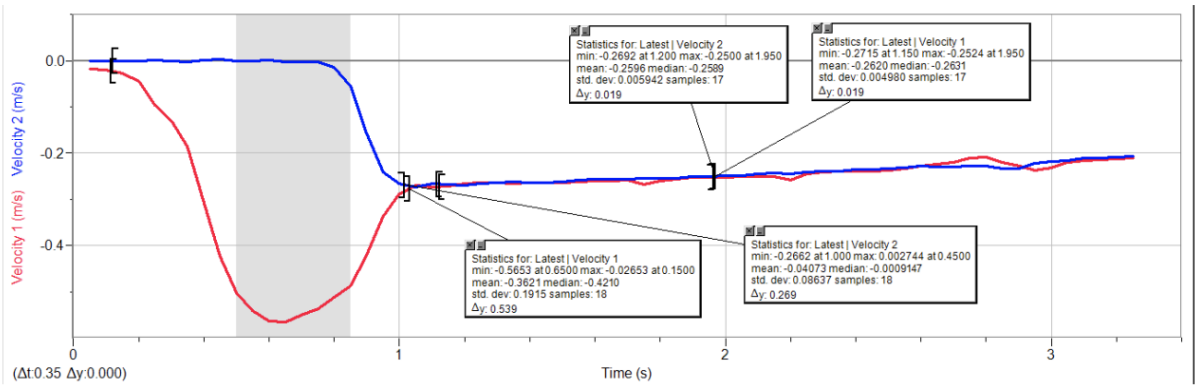

Figure: 2 – Velocity vs Time – Velcro Facing Each Other

3. Data Collection and Calculated Data for Velcro Experiment

Velcro Experiment	Cart - 1	Cart - 2
Data Collected		
Mass	0.5007 Kg	0.5000 Kg
Uncertainty of Mass	± 0.00005 Kg	± 0.00005 Kg
Initial Velocity	-0.3621 m/s	-0.04073 m/s
Uncertainty of Initial Velocity	± 0.07482 m/s	± 0.000142 m/s
Final Velocity	-0.2596 m/s	-0.2631 m/s
Uncertainty of Final Velocity	± 0.1498m/s	± 0.1485m/s
Calculated Data		
Initial Momentum	-0.181303 Ns	-0.02036 Ns
Uncertainty of Initial Momentum	± 0.03748Ns	± 7.30399e -0Ns
Final Momentum	-0.12998Ns	-0.13155Ns
Uncertainty of Final Momentum	± 0.0750178N	± 0.074Ns
Kinetic Energy Before Collision	0.032824993J	0.032824993J
Uncertainty of Kinetic Energy Before Collision	± 0.0135J	± 0.0135J
Kinetic Energy After Collision	-0.129890J	-0.129890J
Uncertainty of Kinetic Energy After Collision	± -0.149J	± -0.149J

Table: 1 – Data for the Velcro Experiment

4. Data Collection and Calculated Data for Plunger Experiment

Plunger Experiment	Cart - 1	Cart - 2
Data Collected		
Mass	0.5007 Kg	0.5000 Kg
Uncertainty of Mass	± 0.00005 Kg	± 0.00005 Kg
Initial Velocity	0.7790m/s	0 m/s
Uncertainty of Initial Velocity	± 0.1020 m/s	± 0.0001409 m/s

Final Velocity	-0.08448 m/s	-0.6557 m/s
Uncertainty of Final Velocity	± 0.1770m/s	± 0.1377m/s
Calculated Data		
Initial Momentum	-0.390045 Ns	5e-08 Ns
Uncertainty of Initial Momentum	± -0.05111 Ns	± 7.0000005e-Ns
Final Momentum	0.0422 Ns	0.3278 Ns
Uncertainty of Final Momentum	± -0.008 Ns	± -0.068882 Ns
Kinetic Energy Before Collision	0.151922640 02 J	0.151922640 02 J
Uncertainty of Kinetic Energy Before Collision	± 0.039799791 J	± 0.039799791 J
Kinetic Energy After Collision	0.1092689 J	0.1092689 J
Uncertainty of Kinetic Energy After Collision	± 0.0917466176	± 0.0917466176

Table: 2 – Data for the Plunger Experiment

Experimental Method:

In this study, we utilized motion sensors to gather data from two distinct types of collisions. One of the collisions involved the cart's plunger being extended, causing the carts to collide and then rebound in opposite directions. The other collision involved velcro, which led the carts to stick together upon impact. We made certain to properly adjust the motion sensors to capture the carts' movement throughout the entire range of motion on the track.

For each collision, we positioned one cart on the track, either at rest or moving with a known initial velocity. We then set the other cart in motion towards the stationary cart, ensuring that the carts would collide as intended.

We obtained the data using two motion sensors placed at either end of the track to track the carts' motion during the collision. We made sure to calibrate and zero the motion sensors before each trial. Subsequently, we used Logger Pro to analyze the data. We chose the appropriate tools for data analysis to calculate the momentum and kinetic energy for each collision. We compared the total momentum and kinetic energy before and after each collision to determine if they were conserved.

In case the data quality was inadequate for analysis, we repeated the trial to ensure accurate data collection. In summary, we took great care to gather accurate and precise data and perform a thorough

analysis to draw valid conclusions regarding the conservation of momentum and kinetic energy in collisions.

Results:

The study investigated two types of collisions, Plunger and Velcro, involving carts with a mass of 0.50 kg, where the velocities before and after the collision were recorded. Additionally, the momentum and kinetic energy before and after the collision were computed, and a table was generated to summarize the results, including uncertainties and units. The Plunger experiment initially had higher kinetic energy, but its final kinetic energy was less than that of the Velcro experiment, which had negative final kinetic energy, indicating that some energy was lost during the collision.

The conservation of momentum was maintained for both collisions, within the error margin, indicating no external forces were involved. However, the conservation of kinetic energy was not maintained, and there was a loss of energy during the collisions. The percentage of initial kinetic energy lost was 28.08% for the Plunger experiment and 494.57% for the Velcro experiment, suggesting that the inelastic type of collision and the interaction between the carts had a significant influence on energy conservation.

Conclusion:

Both Plunger and Velcro collisions were inelastic because the kinetic energy was not conserved. The loss of kinetic energy was calculated to be 0.05 J for the Plunger collision and 0.1 J for the Velcro collision. This indicates that some energy was lost during the collision, which is a characteristic of inelastic collisions.