11/1/2012 Name- Sagar Desai

Partners- Alaoudin

Doumbia

Cortez

Collision

**Objective-** To verify consideration of linear momentum in elastic and inelastic collision

**Procedure**- Two sliders with certain mass were allowed to slide on a bar. To reduce the force of friction the bar were pumped with air. Two photo gates were placed on the bar to record the velocities of the sliders. The experiment was distributed in three cases.

**Case 1**- One slider was placed between the photo gates with initial velocity of zero. And the other slider was push with certain velocity which was recorded by one of the photo gate. After the collision each of the slider moved in the opposite direction with some velocities, which were recorded by the respective photo gates.

Data extracted-

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| m1 (kg) | m2 (kg) | v1 (initial m/s) | v2(initial m/s) | v1’(final m/s) | v2’(final m/s) |
| .21048 | .20193 | .620î | 0î | -.046î | .571î |

\*v2 and v1’ are negative because the respective sliders travel in negative direction. î signifies the unit vector on x axis . This condition is valid in Case two as well.

The respective momentums (p) were found using masses and respective velocities.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P1(m1v1) (kgm/s) | P2(m2v2) (kgm/s) | Pinitial=P1+P2 (kgm/s) | P1’(m1v1’) (kgm/s) | P2’(m2v2’) (kgm/s) | Pfinal=P1’+P2’ (kgm/s) | %ΔP |
| .1305î | 0 | .1305î | -.0097î | .120î | .1103î | 16.6% |

Kinetic energies

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| K1(.5m1v12)  (J) | K2(.5m2v22)  (J) | Kinitial=K1+K2  (J) | K1’(.5m1v12’)  (J) | K2’(.5m2v22’)  (J) | Kfinal=K1’+K2’  (J) | %ΔK |
| .040 | 0 | .040 | 2.2×10-4 | .0344 | .035 | 13.3% |

**Case 2**- The sliders were initially placed on the either sides of the photo gate. Then each of the slider was pushed with a certain velocity, which was recorded by the photo gate. After the collision each of the sliders bounced back in opposite directions with certain velocity, which was again recorded by the photo gate.

Data extracted-

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| m1 (kg) | m2 (kg) | v1 (initial m/s) | v2(initial m/s) | v1’(final m/s) | v2’(final m/s) |
| .21048 | .21090 | .668î | -.715î | -.321î | .257î |

Respective momentums (P)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P1(m1v1) (kgm/s) | P2(m2v2) (kgm/s) | Pinitial=P1+P2 (kgm/s) | P1’(m1v1’) (kgm/s) | P2’(m2v2’) (kgm/s) | Pfinal=P1’+P2’ (kgm/s) | %ΔP |
| .1406i | -.1508î | -.010î | -.0676î | .0542î | -.013î | 26% |

Kinetic Energies

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| K1(.5m1v12)  (J) | K2(.5m2v22)  (J) | Kinitial=K1+K2  (J) | K1’(.5m1v12’)  (J) | K2’(.5m2v22’)  (J) | Kfinal=K1’+K2’  (J) | %ΔK |
| .047 | .053 | .1 | .010 | .007 | .017 | 141.9% |

Case 3

The slider on the right is gently pushed and the slider on the left is pushed with considerable force. But in this case the end of the right slider is covered with wooden piece and the end of the left slider facing the right slider is attached to a pin. So, after the collision the sliders get attached to one another in move in the same direction. And as in case one and two the photo gates records the speed.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| m1 (kg) | m2 (kg) | v1 (initial m/s) | v2(initial m/s) | v1’(final m/s) |
| .21070 | .21056 | .330î | -.953î | -.233î |

Respective momentums (P)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| P1(m1v1) (kgm/s) | P2(m2v2) (kgm/s) | Pinitial=P1+P2 (kgm/s) | Pfinal (kgm/s) | %ΔP |
| .07î | -.2î | -.13î | -.098î | 28% |

Kinetic Energies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| K1(.5m1v12)  (J) | K2(.5m2v22)  (J) | Kinitial=K1+K2  (J) | Kfinal (J) | %ΔK |
| 5.6×10-4 | .0042 | .0047 | .0114 | 83% |

Conclusion- Case 1 is an elastic collision because both momentum and kinetic are conserved. Technically Case 2 should be an elastic collision. But for some strange reason the %ΔP and %ΔK are very high. So it should be categorized as an elastic collision depending on the results. Case 3 is a complete inelastic collision. Because the sliders move together after collision and the momentum as well as kinetic energy is not conserved.