Lab Report Collision

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Aim: Study the changes of energy and momentum before and after collisions

Apparatus: Air track, gliders, digital timer, air pump, light gates, digital balance, weights, sticks.

Requirements:

- Investigate the change of energy and momentum in several situations of elastic collisions.
- Investigate the change of energy and momentum in several situations of total inelastic collisions.
- Investigate the change of momentum in recoil.

Groups of Collisions:

1. Elastic (with elastic rings on gliders), mass of 1st object (m_1) equal to mass of 2nd object (m_2).
2. Elastic (with elastic rings on gliders), $m_1 \neq m_2$.
3. Inelastic (no elastic rings), $m_1 = m_2$.
4. Total inelastic(with stickers on gliders), $m_1 = m_2$, initial velocity of 2nd object $u_2 = 0$.

Notice:

- Be patient when adjusting the balance of the air track.
- Turn on the air pump before putting the glider on the air track and turn off the air pump after removing the glider.
- Set the timer on Col (Collision) mode. When doing the 4th experiment, remember to turn on S2 mode of Col mode.

- m_1 should be at the side of light gate 1, m_2 should be at the side of light gate 2.

Report: Take right direction as positive direction.

	m_1 (kg)	m_2 (kg)	u_1 (m/s)	v_1 (m/s)	u_2 (m/s)	v_2 (m/s)
1	0.1793	0.1793	1.56	-1.38	-1.81	1.21
2	0.2298	0.1793	2.47	-2.97	-1.87	1.47
3	0.1793	0.1793	1.53	-0.122	-1.46	0.136
4	0.1793	0.1793	2.44	N/A	N/A	1.03

Use the equation $P = mv$ and $KE = mv^2 2$. So that we can get

	P_{total} before	P_{total} after	KE_{total} before	KE_{total} after
1	-0.044825	-0.030481	0.511874605	0.301986025
2	0.035085	-0.418935	1.491787095	1.207246095
3	0.012551	0.0025102	0.400959625	0.002992517
4	0.437492	0.369358	0.53374024	0.19021937

and accurate to 3 significant figures:

	P_{total} before	P_{total} after	KE_{total} before	KE_{total} after
1	-0.0448	-0.0305	0.512	0.302
2	0.0351	-0.419	1.49	1.21
3	0.0126	0.00251	0.401	0.00299
4	0.437	0.369	0.534	0.190

Conclusion and Evaluation:

For all groups, momentum in total decrease and kinetic energy decrease. In ideal condition, the momentum should be conserved but here the momentum decrease and there may be reasons listed below:

- There's still friction between air track and glider that cause v just before collision smaller than u when been measured.
- The air track is not balanced, causing a bit inclined and acceleration due to gravity. So v changes over the motion

The energy is also not conserved because there may be heat loss, and loss of energy that is transfered to external environment in the form of energy of wave (sound), etc.

Also, comparing KE_{total} **before** and KE_{total} **after** in different groups and we can find that the **4th group** has the largest energy loss because it is total inelastic collision.