Momentum Conservation in 2 Dimensions Lab

Question: Is momentum really conserved in real conditions? How elastic/inelastic are these collisions?

Accepted Values: Use Video Physics to determine the initial velocities of both objects as well as one final collision velocity and then calculate what the velocity of the other final object should be using momentum conservation. Do this for your elastic collision and your inelastic collision.

Make sure to record your uncertainties.

Materials:

- 4 spheres of varying elasticity
- iPad with Video Physics
- Meter stick or ruler for scale
- Electric balance

V_x-t graph only.

* Assume ~~V_x~~ $V_x = 0$ m/s

toget $v_i' = v$

$V_{1x} = 0$	V_{1x}'
V_{1y}	V_{2x}'
$V_{2x} = 0$.	V_{1y}'
V_{2y}	V_{2y}'

Procedure:

1. Find 4 spherical objects; two that you e
   you expect to have an inelastic collision
2. Determine the mass of your spheres usi
3. Set up your measurement space. You'll
   blend in with the surface you're on, put
   so you can scale everything in Video Phy
   downward but over the edge is a good i
4. Practice colliding your objects, making s
   (head-on and glancing collisions are both
   acceptable).
5. Once you're confident, record a video of
6. Repeat the above steps with your second pair of objects.

Observations:

[redacted]

Perform these steps for both your elastic and inelastic collisions.

1. Import the video into Video Physics and track one object at a time (this means you'll have to repeat this step twice), setting the scale and exporting the horizontal velocity vs time and vertical velocity vs time graphs for each object.

2. Using your data, determine the momentum vectors for each object before and after the collision, as well as the kinetic energies.

3. Using the initial momenta and one final momentum, calculate the theoretical final momentum of the other object.

4. Determine if total momentum and total kinetic energy were conserved.

5. Calculate your percent losses $\left(1 - \frac{actual}{theoretical}\right) \times 100\%$ for momentum (angle and magnitude separately) and kinetic energy from before the collision to after.

Conclusion ← 6. Compare your predictions about the elasticity/inelasticity of the collisions with your above calculations.

Error Analysis:

1. Final velocity percent errors: experimental vs accepted, graph vs accepted.
2. Momentum conservation errors: experimental vs accepted.
3. Kinetic energy conservation errors: experimental vs accepted.

} Discuss.

Discussion:

[redacted]

3. Two objects with the same mass and equal but opposite velocities collide. Determine the result in these two situations. Use calculations to prove your answers.
   a. The collision is perfectly inelastic.
   b. The collision is perfectly elastic.

eqtns $p = 0$

4. If two objects have a collision while in free fall, is momentum conserved for the two objects?

$p \neq 0$.