Collision Analysis

Momentum Before and After a Collision, from Video

Aim:

You are investigating how the total momentum of two balls before a collision compares with their total momentum after the collision.

Method:

1. Film a short video of two balls colliding (e.g. marbles), viewed from directly above, with a ruler visible for scale, then upload it using Upload a collision video.
2. Select Calibrate, click two points along your ruler in the video, and enter its real length in centimetres.
3. Weigh each ball and enter its mass in the Ball A mass and Ball B mass boxes.
4. Select Mark, choose Ball A, then step through the frames (Prev frame / Next frame) to click its position just before impact, and again just after. Repeat for Ball B.
5. Select Vector and drag out an arrow for each ball's direction of travel before and after the collision (four arrows), plus one horizontal vector to use as a fixed reference direction.
6. Select Angle, then click your reference vector and one of the ball vectors to read off the angle between them. Record this as that phase's Direction.
7. Use the Measurements panel with your calibration to calculate each ball's **speed = displacement ÷ elapsed time** before and after impact. Record speed, direction, mass and momentum for all four rows in your table.
8. Repeat for a second collision video, so you have two independent trials.

Prediction:

Before you draw your vectors: will Ball B move off in exactly the same direction that Ball A was originally travelling, or at an angle to it? Give a reason for your answer.

My prediction: .....

Check using your video once you have drawn your vectors.

Results:

Ball	Phase	Speed (cm/s)	Direction (°)	Mass (g)	Momentum (kg cm/s)

Analysis:

Convert each mass to kilograms (divide by 1000) before calculating **momentum (kg cm/s) = mass (kg) × speed (cm/s)** for each of your eight rows.

For each trial, add Ball A’s and Ball B’s momentum together before the collision, and again after. What do you notice about the total momentum before and after the collision?

How does the angle between the balls after the collision relate to the angle of approach?

What sources of uncertainty affect your velocity measurements most?

How would your results change if the balls had different masses?

What assumptions are you making about the surface and the camera angle?