Momentum Essay, Research Paper

Momentum Lab

The game of pool sounds simple, all one must do is hit the cue ball, towards another ball, and making that ball fall into a pocket. It sounds simple, but how come only a small percentage of people are actually good at it? The people that excel at the game of pool are probably not physically stronger, but you can be sure that they know all about momentum. Momentum is literally mass in motion; it is a vector quantity. Momentum is equal to its velocity multiplied by its mass. The purpose of this lab was to prove that momentum is conserved under all conditions. To prove this, we took data in different conditions, and then we drew vector diagrams that show momentum is conserved.

Materials and Methods:

1) The following materials were obtained: a metal ramp, a two marbles, a tilt stand, a C-clamp, masking tape, piece of carbon paper, piece of blank paper, and a meter stick.

2) The ramp was clamped to a counter with a C-clamp.(all the counters were the same height)

3) The tilt stand was pushed way to side, slightly to the side, or not moved depending on the direction assigned to you.

4) The incident marble was dropped without the target marble. The drop point was marked.

5) The incident marble was dropped with the target marble. The drop point was marked.

6) A piece of blank paper was taped to the ground where the target marble hit. A carbon paper was then put over that.

7) The incident marble was dropped from top of ramp 20 times.

8) Distance was measured between the base of ramp to the estimated center.

9) Distance was measured from the base and center to the estimated center where the incident and the target dropped.

10) Deviation was calculated.

Results:

Data Table 1: Target distances/Incidence distances traveled

Group# Direction of base No collision

(cm) Target distance x (cm) Target distance y (cm) Incident distance x (cm) Incident distance y (cm)

1 Head on 46.5 43 7

2 Head on 45 41.5 1.5 8 7

3 Way to side 46 31 22 16 12

4 Way to side 43.5 27 14 24 1.7

5 Medium to side 47 37 13 10.5 15.5

6 Medium to side 47.6 19.2 22.3 26.3 19.4

7 Slightly side 41 2 6 38 5

Data Table 2: Deviation

Group#1 No Collision Dr Incident Range Dr Target Range Dr

1 0.7% N/A 1.6%

2 3.8% N/A 4.16%

3 2.11% 8.7% 3.69%

4 2.74% 5.6% 7.48%

5 0.48% 3.37% 1.18%

6 0.74% 2.43% 1.32%

7 2.1% 5.7% 3.7%

Sample Calculation:

Vector Graph#1

Err = sqrt[(46.5-43)^2 + (7)^2)] = 7.83

Err = 7.83 / 46.5 \* 100= 16.8%

Theta inv. tan(7 / 43) = 9.25 degrees

Discussion:

In Data Table 1 we see the no collision, target, and incident distances, and the direction of the base. The direction of the base did not affect the no collision distance; the distance traveled was always around 44 cm, but that is the only thing it didn t affect. The target distance generally decreased by 10 cm, as the direction changed from head-on, way to side, medium to side, and slightly to side. The incident distance x however does the exact opposite, it decreases as the direction changes from head on, to way to side, to medium to side and slightly to side. As the target distance x goes down, incident distance goes up, and they pretty much even themselves out, just like how a rocket s momentum evens itself out when its thrusters are on. The target and incident y distances had no general trends or patterns.

The vector graphs show that momentum is conserved. The x components add up to the no collision distance. This shows that momentum is not lost, since the distance is unchanged. However, the graphs have a high error rate. The data we took had many sources of error. There was no actual distance or angle for the direction of the base. The angle for: way to side, medium to side, and slightly to side, are not constant and this is the greatest cause for error. Friction in the ramp and air friction contributed to error as well.

Air friction could be eliminated as a source of error if this experiment was done in a vacuum. If a certain distance and angle was assigned to way to side, medium to side, and slightly to side, the data would have been much more reliable.

This experiment should be done again in the future changing the variable. Such as using different ramps, or billiard balls hitting each other on a flat surface, replacing the marbles with a bouncy ball.

Conclusion:

The vector graphs show that momentum is conserved. In a perfect collision the vector graph would be a triangle. If an object does not get hit head-on, and the two objects move, they move perpendicular to each other.

The lab shows momentum is not lost, it just gets transferred into different objects. In a perfect collision, the momentum of the two objects after they collide adds up to the initial momentum, in a perfect head-on collision, all the momentum of the first object is transferred into the second object which is at rest. This information would benefit pool players so they know where to hit a ball.

This lab s data is not reliable. The reliability can be improved, if this lab was done in a vacuum, used close to perfect elastic marbles. Used another clamp or a device so the base could have been more stable and not move around after each trial, and also explain in more detail what way to the side, medium to the side and slightly to the side is.

Don t quit your day job and become a professional pool player just yet, you still need to work on your aim.