Elastic collisions - lab report example

Science, Physics

Elastic Collisions

Elastic collisions the lab: of lab of lecturer: Lab partners 2. In this experiment the main purpose is to study the conservation of total linear momentum and the conservation of energy in a collision between two pucks of equal mass. A frequency generator will be used to determine the time elapsed by the pucks as they collide against a wall. The data recorded will then be used t determine the amount of energy conserved in the motion.

Introduction

A perfectly elastic collision is one in which both kinetic energy and momentums are conserved. A close approximation of such an ideal elastic collision is provided by the interaction of two pucks, both of which are free to move on a nearly frictionless air table surface. Since the forces involved are non-contact and radial, no angular momentum or angular kinetic energy is transferred or imparted to the pucks during the time when they interact. This means that the momentum is conserved:

Since the momentum is a vector, it can be broken down into x and y components. The momentum must be conserved for each axis.

This means that kinetic energy is also conserved

Energy is a scalar factor and therefore there is no need to break the express down into its components.

Objective

The objective of this experiment is to study the conservation of total linear momentum and the conservation of energy in a collision between two pucks of equal mass.

Procedure

The air table is leveled by turning on the air compressor and then placing one of the pucks at the center of the table and checking for any movement. Adjustment of the two front legs will eliminate any form of tilt either to the right or to the left sides. The single rear leg is adjusted in order to eliminate any forward and backward tilt. The inspector should inspect the apparatus before they are turned. With the spark generator turned off, one of the pucks is placed near the center of the table with an initial velocity of zero and using the plastic launcher with the rubber band, it is used to shoot the other puck p1 towards p2. The collision is not head on and therefore the puck moves off at a different angle after the collision. After one has had enough practice to control the motion, two wires are attached from the pucks to the spark generator and the frequency of the generator is set to 20 Hz and let to warm for about a minute. The pedal step is lightly pressed to launch the puck and the pedal is released after the collision has occurred before the puck hits the wall.

Results

Distance travelled

Time elapsed

Average v

Angle of travel

Vx

Vy

P1 before

0. 22 m

0. 55 sec

0. 4

0

0. 4

0

P1 after

0. 15 m

0. 5 sec

0. 3

27

0. 26

0. 136

P ½ before

0. 00 m

0. 00 sec

0

0

0

0

P ½ after

0. 105 m

0. 55 sec

0. 190

51

0. 1195

0. 427

Momentum is conserved and therefore:

For the y axis

For kinetic energy

Data analysis

a. How did you find the elapsed time? Explain mathematically why this method works.

To determine the elapsed time, we consider the given frequency and the recorded distance during the experiment. Time is a function of frequency and therefore we use the formula

After obtaining the frequency, we consider the number of oscillations per second and hence obtain the elapsed time by multiplication of the frequency by the number of oscillations.

b. Did the center of the mass travel in a straight line? What was its velocity?

The center of the mass travelled in a straight line along the x axis at a velocity of 0. 4 m/s.

c. Was the momentum conserved in the x direction? In the y? Overall?

Momentum conserved in the x direction

Momentum conserved in the x direction

Momentum conserved overall

d. What do these results indicate?

These results indicate the conservation of total linear momentum and the conservation of energy in a collision between two pucks of equal mass.

e. Was this an elastic collision? Why or why not?

This collision is an example of an elastic collision motion. This is because energy is conserved after the collision.

Conclusion

From the experiment carried out above, the objective was achieved and the conservation of total linear momentum and the conservation of energy in a collision between two pucks of equal mass determined. The kinetic energy in the system was found to be.

References

Browne, Michael E., Schaums outline of theory and problems of physics for engineering and science, McGraw-Hill Companies. p. 58, (2004).

W J Stronge , Impact mechanics, Cambridge UK: Cambridge University Press. p. 12, (2004).