

EXPERIMENT #9 - PHYSICS 230

Collisions in Two Dimensions

OBJECT: To study perfectly elastic and partially elastic collisions for two dimensions by using the air table.

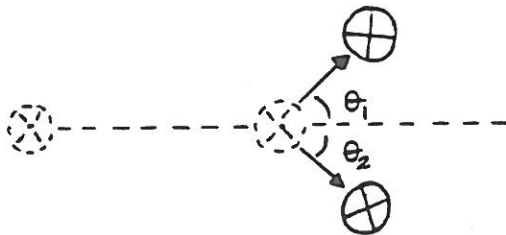
EQUIPMENT: Air table and accessories

THEORY: Refer to chapter 10 of Resnick and Halliday

GENERAL DIRECTIONS:

A. Perfectly elastic collisions:

1. Examine the air table and its accessories in order to determine their operational principles. Be sure you understand how to properly use the Polaroid camera.
2. Securely fasten the camera in its proper position on the mirror support structure. Ask the lab assistant or instructor for instructions for adjusting and using the camera. Turn on the air flow to the air table, place the pucks on the air table, and proceed with the collision experiment. The shutter release button should be depressed just before the experiment begins and released just before the pucks rebound from the wire at the edge of the air table.
3. After the exposure is made, grip the small white tab of paper and pull it straight out of the camera. This opens a door and a yellow tab pops out. Pull the yellow tab straight out with a reasonably swift motion. Hold the developing picture by the yellow tab for about 120 seconds and then quickly strip the white paper (the print) off the brown paper starting from the end nearest to the yellow tab. Be very careful not to get any jelly on your clothes or in your eyes; wash immediately with water if you get any of the jelly on yourself.
4. When the print is ready, use an opaque projector to project the print's image on a screen or wall in order to analyze the collision.
5. For the perfectly elastic collision experiment place a magnetic puck near the center of the air table so that it is stationary. Push or launch a second magnetic puck towards the stationary puck so that they collide without actually coming into physical contact. The two pucks should interact magnetically and deflect from each other as shown below:



By using the camera properly as outlined in the preceding parts of this experiment, photograph this collision. In the analysis of the picture measure the angles θ_1 and θ_2 , and measure the initial and final speeds of both pucks.

6. Verify the results of this experiment by theoretical calculations which should include the conservation of momentum and energy. Explain why there may be any experimental error .

B. Partially elastic collision

1. For the partially elastic collision experiment place a non-magnetic puck near the center of the air table so that it is stationary. Launch a second non-magnetic puck towards the stationary puck so that they collide and deflect from each other at a non-zero angle, as indicated by the diagram in section A, part 5 of this experiment. Photograph and analyze this collision using the same general procedure as outlined for the perfectly elastic collision in section A.
2. Using the experimental results and the proper theoretical equations calculate the per cent of the initial kinetic energy that was lost during the collision. Also, verify by calculation that these experimental results show that momentum is conserved. Explain your results and why there may be any experimental error.