EXPERIMENT #11 - PHYSICS 230

ROTATION AND TRANSLATION IN TWO DIMENSIONS

OBJECT: To study the translation and rotation of a rigid body resulting from a partially elastic collision in two dimensions by using the air table.

EQUIPMENT: Air table and accessories

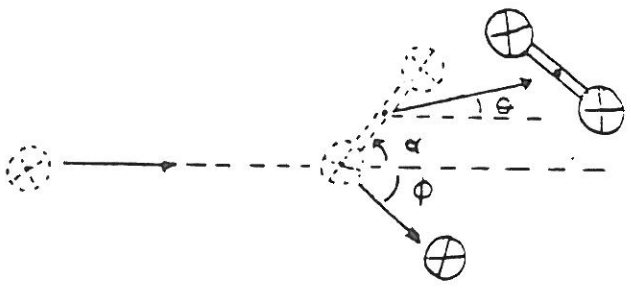
THEORY: Refer to chapters 10, 11, 12, and 13 of Resnick and Halliday.

GENERAL DIRECTIONS:

1. Examine the air table and its accessories in order to determine their operational principles. Refer to experiment number nine ("Collisions in Two Dimensions") for the proper positioning and operation of the Polaroid camera.

2. For this experiment a specially constructed rigid body is used. This body is a system of two non-magnetic pucks that are rigidly joined together by a light rod as shown below:

3. Carefully place this special rigid body at the center of the air table. Be sure that the body slides easily over the surface of the air table when the air turned on. When the rigid body is stationary, push or launch a non-magnetic puck towards the rigid body so that there is a collision with a puck on one end of the rigid body. Also, for better results the rigid body should be oriented so that it is at an approximate angle of 45° with the initial direction of the launched puck as shown below:



$\alpha \cong 45°$

By using the camera properly photograph this collision.

4. Measure the mass of the rigid body and the colliding puck. Also, measure the mass distribution of the rigid body in order to find its moment of inertia.

5. When the photograph of this experiment is ready, use an opaque projector for the analysis of this collision. The analysis should include the measurement of velocities, angular speeds, and any needed angles and distances.

6. Verify the results of this experiment by the proper theoretical calculations which should include the conservation of linear and angular momentum. Also calculate the per cent of the initial kinetic energy that was lost during the collision. Explain your results and why there may be any experimental errors.