

## Lab Activity: Projectile Launched Horizontally

Due Date:

Purpose: To predict the launch speed and landing speed of a marble that is rolled horizontally off the edge of a table.

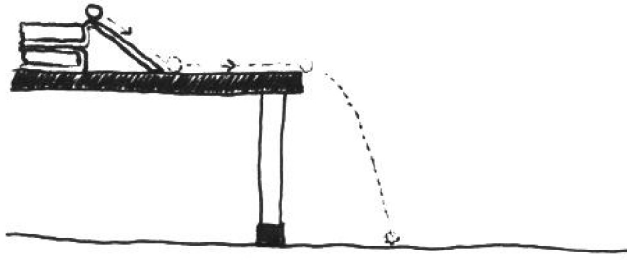
Background:

- kinematics equations can be used to describe the horizontal motion and vertical motion of a projectile as *independent* 1-dimensional motions
- theoretical acceleration down a frictionless incline of angle  $\theta$ :  $a = g \sin \theta$
- assumptions:
  - friction and air resistance are negligible
  - table surface is perfectly horizontal

Materials: marble, textbook(s) or clipboard, meter stick, printer paper, carbon paper, tabletop, tape, angle indicator, string, washer

Procedure:

- 1) Set up the textbooks (or clipboard) at your table according to the following diagram.



- 2) Tape a sheet of white paper to the floor such that the marble lands on it after it rolls off the table, and lay a piece of carbon paper on top of the sheet.
- 3) Roll the marble several times by releasing it from the top of the ramp, and allow it to strike the carbon paper, leaving marks on the white paper below.
- 4) Measure the horizontal distance from the edge of the table to each of the marks and record them in a data table. (Note: you can use the string and washer as a plumb bob to determine where the edge of the table lines up on the floor)
- 5) Measure the height of the table from the floor.
- 6) Measure the angle of the ramp incline using the angle indicator.

### Targeted Questions:

- 1) Using the measurements of the average horizontal displacement and the height of the table, calculate the horizontal launch speed of the marble as it rolled off the table.
- 2) Using the theoretical value of the acceleration down the ramp and the appropriate kinematic equation(s), calculate the speed of the marble as it reached the bottom of the ramp. How should/does this value compare to your calculation from question 1?
- 3) Find the (a) horizontal speed, (b) vertical speed, and (c) overall speed of the marble just before it landed.

Mr. Dove