Horizontal Projectile Ramp with Ball

P2-8490

INSTRUCTIONAL GUIDE

Contents

- Aluminum ramp with mounting plate and clamp (6” high, 13” long)
- 2 Screws for consistent starting heights
- ¾” steel ball

Recommended for activities:

- Timer and Photogates (P4-1450)
- Wind-Up Dual-Scale Fiberglass Tape Measure (01-3930)

Background

The Marble Projectile Ramp is used to launch a marble horizontally from a table or desk. The included screws can be moved to provide up to four different starting points and velocities. You can use a photogate to measure the marble’s velocity as it exits the ramp and predict where it will land using projectile motion equations.

Relevant Science Education Standards:

- An object that is not being subjected to a force will move at a constant speed in a straight line.
- All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.
- Perform measurements and calculations to describe the speed and direction of an object.

Activities

Using Velocity to Predict Range:

1. Screw one of the screws through one of the holes in the ramp. Hold a marble against the screw with your finger then quickly let go. Releasing the ball from a different hole will result in a different velocity at the bottom of the ramp.
2. Clamp a photogate in place so that the light beam can pass through the hole in the base of the ramp. Using the diameter of the marble and the time measured by the photogate, you can calculate the velocity of the marble at the bottom of the ramp.
3. Using the velocity and the vertical distance the ball falls, you can then calculate how far the marble will go horizontally when it hits the ground. Mark the distance with tape, or place a cup there. (Be sure to account for the height of the cup – aim for the top, not the bottom!)

Using Energy to Predict Velocity:

1. Measure the marble's initial height above the table and calculate its potential energy.
2. Predict the ball's kinetic energy at the bottom of the ramp. Assume that all of the potential energy becomes translational motion, and calculate the marble's velocity at the end of the ramp.
3. Your prediction is probably going to be about 30% too fast, which means that some of the energy is unaccounted for. Ask students to find the "missing" energy. (They'll find it in the rotation of the rolling ball!)

Related Products

Horizontal Projectile Lab (P4-1406) Horizontal Projectile Lab for the Physics workshop. Challenge students to predict the range of a projectile launched from the ramp!

Mini Projectile Launcher (94-1970) This simple but precise launcher is versatile and great for indoor classroom use with projectile motion studies! The Mini Projectile Launcher projects 16 mm steel balls at ranges suitable for use on the benchtop or from the bench to the floor.

Vertical Acceleration Demonstrator (P3-3520) The Vertical Acceleration Demonstrator illustrates a concept that is crucial for understanding projectile motion: that the acceleration due to gravity only affects an object's vertical motion.