

Launcher Speed Lab

Teacher's Guide

Topic:

Vectors and Projectiles

The following information is provided to the student:

Question:

What is the launch speed of the projectile launcher?

Purpose:

To determine the launch speed of the projectile launcher.

A complete lab write-up includes a Title, a Purpose, a Data section, and a Conclusion. The Data section should include a diagram of the experimental setup with measured distances (or customary symbols for pertinent quantities) indicated on the diagram. There should be several trials of good d_x data values; units should be indicated. An average d_x value should be reported and subsequently used to calculate the launch speed. The calculations should be organized and clear, identifying the symbols of the variables being used in multiplication and division steps in addition to the numerical quantities. The Conclusion responds to the question raised in the Purpose (as always).

Materials Required:

Projectile launcher and projectile; C-clamp; meter stick; carbon paper; notebook paper; masking tape.

Description of Procedure:

A projectile launcher is mounted on a lab bench and aimed horizontally. The steel ball is launched and its approximate landing location is identified. Students tape a sheet of paper on the floor at the approximate landing location and lay a carbon sheet over the top. The projectile is launched several times until a sufficient number of carbon impressions on the paper allow the exact landing location to be identified. Distance measurements are made in order to use projectile mathematics to calculate the launch speed of the projectile launcher.

Alternative Materials and Procedure:

If a class set of launchers is not available, consider purchasing [Pasco's](#) more expensive Short (ME-6800) or Long-Range (ME-6801) Launcher and using it to conduct a variety of labs in which student groups are assigned varying launch angles, launch speeds, launch heights and target heights. Long mailing tubes can be cut to varying heights and placed on the floor as targets. Students can perform calculations for their launch parameters and determine the location at which the targets (mailing tube) must be placed in order for the projectile to land in it.

Safety Concern:

There is always a higher than usual level of risk associated with working in a science lab. Teachers should be aware of this and take the necessary precautions to insure that the working environment is as safe as possible. Goggles should be worn by all members of a lab group to prevent eye injury from accidental collisions with the projectile. Students should never look down the muzzle of the launcher.

The Laboratory

Care should be taken at all times when launching the projectile. Student *horseplay* and off-task behaviors should not be tolerated.

Suggestions, Precautions, Notes:

1. [Pasco Scientific](#) sales a mini-launcher (ME-6825A) which comes with a steel ball, a plumb bob and a built-in protractor scale. The launcher can launch the steel ball at three different speeds and at multiple angles (including downwards, thanks to a magnet which holds the ball in place as the muzzle is pointed downward). While pricey, it is Pasco's least expensive launcher.
2. Avoid losing the steel balls; a hefty price will be paid for their replacement.
3. This lab is a preface to later labs. Once the launch speed is known, the value will be used in the Maximum Range Lab, the Hit the Target Lab, and the Hit the Target - The Sequel Lab. If using more than one launcher, then be sure to number the launchers so that students can return to the same launcher in subsequent labs.
4. In advance of the lab, experiment with the three launch speed to determine which speed is the best match to the size of your lab space.
5. Emphasize safety. Students are using a *gun* - a low speed gun, but still a gun.

Auxiliary Materials:

None

Scoring Rubric:

VP10. Launcher Speed Lab	Score
___ Included, labeled and organized all parts of the lab report.	
___ Data section includes diagram of experimental set-up; the d_x and d_y values are labeled on the diagram. Correctly used kinematic equations to determine the launch speed. Work is organized and labeled; clearly indicated the symbols of the quantities being used in multiplication and division steps. Launch speed value is reasonably accurate; units are stated.	___/___
___ Conclusion states the launch speed (with units) of the projectile launcher.	

Connections to The Physics Classroom Tutorial:

The following reading is a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/vectors/u3l2e.cfm>

Connections to Minds on Physics Internet Modules:

There is no sublevel in the Vectors and Projectiles module that focuses on the method of projectile problem-solving.