Lab: Cons. of Momentum, Energy: The Ballistic Pendulum

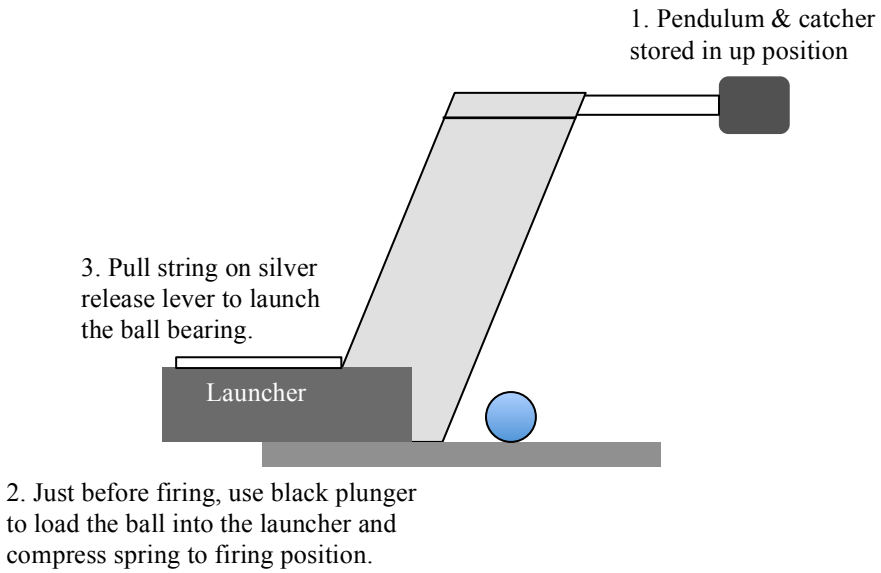
AP Physics

Background
Conservation of momentum and conservation of energy are two fundamentally important physics laws, and many common problems require the appropriate application of both.

Objectives
To experimentally determine, in two different ways, the "muzzle velocity" of a bullet leaving a gun. The first approach will use a classic projectile-based, kinematics approach to finding v_{bullet} The second approach will involve using a "ballistic pendulum."

Equipment
Ballistic pendulum unit, w/steel ball (the bullet)
Meter stick
Balance

Procedure

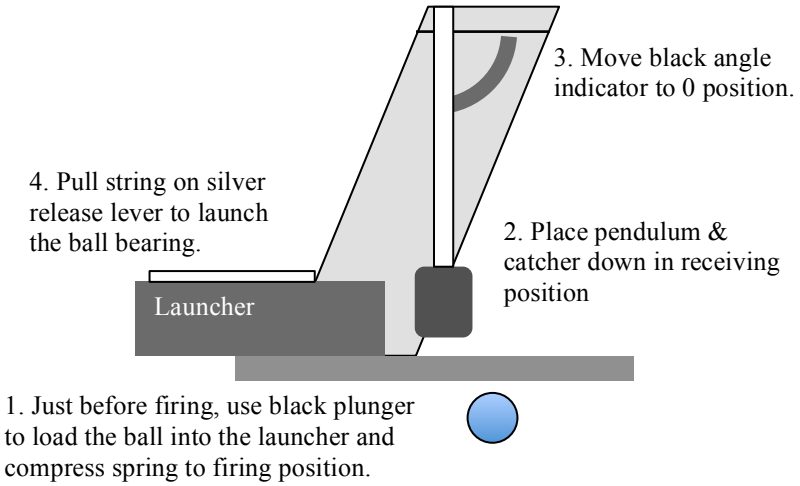


Part A. Muzzle Velocity of the Ball using Kinematics

1. Carefully move the ballistic pendulum arm into the up position where it will be stored out of the way—you won't be using the pendulum for these first measurements.
2. Place the launching unit on a lab table so that the gun is oriented horizontally with at least 4 meters of clear space in front of it. **The gun should *never* be loaded and cocked if there are people moving in front of it.**
3. Load and fire the ball bearing once so that you have some idea of where you'll need to take measurements.
4. In subsequent launchings, take measurements of the ball's projectile motion that will allow you to calculate the ball's velocity as it leaves the gun.

Lab: Cons. of Momentum, Energy: The Ballistic Pendulum

AP Physics



Part B. Muzzle Velocity of the Ball using Conservations of Momentum & Energy

1. Load the ball bearing into the launcher.
2. Carefully move the ballistic pendulum arm back down so that it swings freely, and is hanging directly in front of the launcher.
3. Note the black angle indicator located near the pendulum pivot. Move this indicator into the zero position, or as far down as it will move.
4. Fire the ball into the catcher, and take measurements that will allow you to calculate the velocity of the ball as it leaves the gun.

Questions

There are no specific questions for this lab, but your analysis in the write-up should include a comparison of the muzzle velocities that you've calculated in the two different parts of the lab.

Additional Notes

Make sure that you make sketches of each experimental set-up, with values/variables used in your analysis clearly indicated in the diagrams.

This lab doesn't specifically provide you with a list of what measurements you should be making, so think carefully about what you should record from the experiment. When you've decided what data should be collected create data tables for recording this information during the lab. People who read your work are looking for a table structure where they can find your observed values clearly recorded, so make your data tables large and clear, with lines around them. The very simplest form of data table might look like this:

Header describing data being recorded (unit)	
Data being recorded (unit)	Value
Additional data (unit), Trial 1	Value
", Trial 2	Value
Etc. as needed	Value

In Part B you'll obviously need to record more data in a different data table. Also, in calculating the muzzle velocity of the ball using this data, you'll need to carefully blurb your steps--otherwise, readers won't know what approaches you were using to solve different parts of the problem.