Ballistic Pendulum Lab
(conservation of energy and momentum, and kinematics)

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)
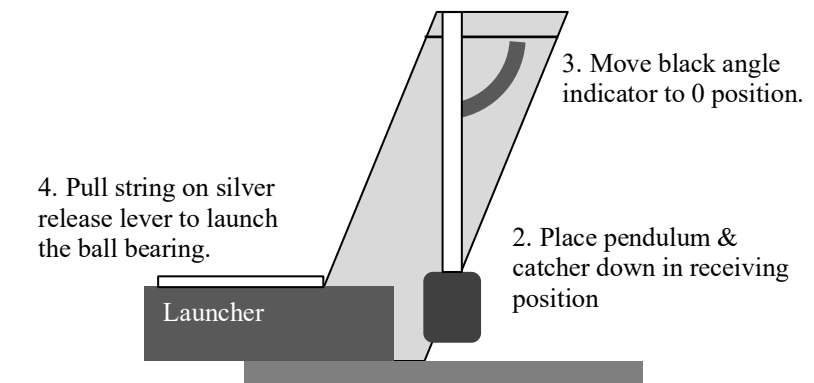Meter stick
Balance

Procedure

Part A. Muzzle Velocity of the Ball using Conservations of Momentum & Energy (in this part, the pendulum attachment will hang down and act like a catch):
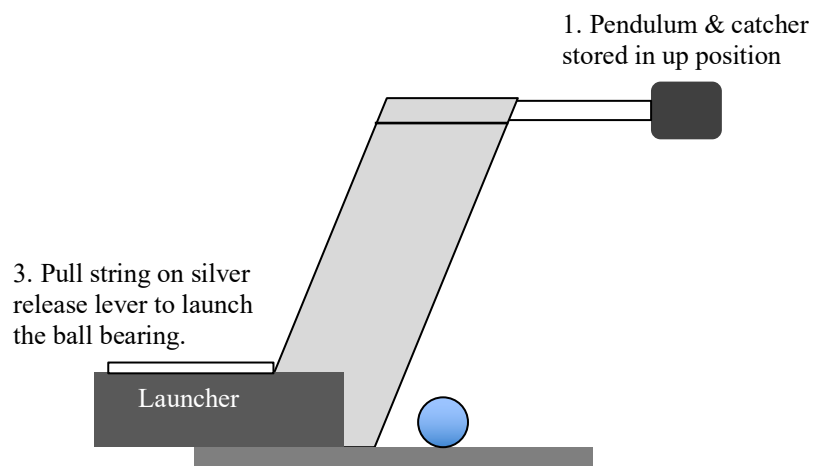
1. You will be using [a video](https://youtu.be/B1Bv_AVnS3c) (that's https://youtu.be/B1Bv_AVnS3c) that will show you this lab being done by moi. Watch the video and take down all the data provided.
2. Derive a general algebraic expression for the muzzle velocity of the "gun" using the parameters provided in the Ballistic Pendulum part of the lab. When done, put in numbers from the experiment and come up with a numerical value. Be sure to blurb your work.

3. Move black angle indicator to 0 position.

4. Pull string on silver release lever to launch the ball bearing.

2. Place pendulum & catcher down in receiving position

1. Just before firing, use black plunger to load the ball into the launcher and compress spring to firing position.

Launcher

Part A. Muzzle Velocity of the Ball using Kinematics (in this part, the device will act like a gun with the pendulum attachment positioned up out of the way—see sketch):

3.) Blurbing like mad, derive a general algebraic expression for the muzzle velocity of the "gun" using the parameters provided in the "gun" part of the lab (this will be an exercise in kinematics). When done, put in numbers from the experiment and come up with a numerical value. Be sure to blurb your work.

1. Pendulum & catcher stored in up position

3. Pull string on silver release lever to launch the ball bearing.

Launcher

2. Just before firing, use black plunger to load the ball into the launcher and compress spring to firing position.

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. You should also compare the energy of the system before the collision in the Ballistic Pendulum part of the lab, and the energy in the system after the collision.

You should also comment on Sources of Error, etc.