PHYS 101 Experiment 4. The Ballistic Pendulum

Preliminary work:

Review "Example 8.8 The Ballistic Pendulum" of the textbook. Note that the bullet is embedded into the wooden block, meaning that the collision is totally inelastic. Therefore, energy is not conserved during the collision. However, after the collision energy is conserved. Show that if m_B is the mass of the bullet, m_W is the mass of the wooden block, and h is the maximum height reached by the pendulum after the impact, the velocity v_0 of the bullet before it hits the wooden block is given by

$$v_0 = \frac{m_B + m_W}{m_B}\sqrt{2gh}.$$

Online Experiment Link:

https://ophysics.com/

Procedure:

1. Open the website given under the "Online Experiment Link". From the top menu choose the menu item "Conservation", and from the appearing drop-down menu choose the experiment "The Ballistic Pendulum".

2. Read the description given at the bottom of the page. Run the simulation and observe the motion of the pendulum and then reset the simulation.

3. Uncheck "Show Initial Bullet Velocity" box, and by sliding the bar set an unknown initial velocity of bullet. Set "Mass of the Bullet" parameter to $m_B = 0.1\,kg$, "Mass of Wooden Block" parameter to $m_W = 4\,kg$, and run the simulation. While the pendulum is swinging, by sliding the horizontal dotted line up and down measure the maximum height reached by the bottom side of the pendulum. Use the relation derived in the preliminary work to calculate the initial velocity of the bullet. Now check the "Show Initial Bullet Velocity" box and note the value of the initial velocity of the bullet. Calculate your percentage error. (Take $g = 9.8\,m/s^2$.)

4. Repeat the above procedure for a total of five different values of the unknown initial velocity, and complete the table below.

$h(m)$					
$v_0(m/s)$ Calculated					
$v_0(m/s)$ Given					
% Error					

5. Write a properly formatted report of your results, convert it into a PDF file and upload it to MOODLE. Deadline for submission is Monday, 10 August 2020 at 07:59 (am). Late submissions will result in deduction of 10 points for each day late.