Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Ballistic Pendulum Lab**

Part 1

g = 9.8 m/s^2 Change in height of the ball/pendulum combination after the collision: \_\_\_\_\_\_\_\_\_\_\_

Mass of the steel ball: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Mass of the pendulum without steel ball: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Calculate the gravitational potential energy of the ball/pendulum combination at its peak.
2. Create a kinetic energy equation for the ball/pendulum combination the instant after collision.
3. Energy must be conserved from the instant the ball is launched, during the collision, and after the collision until the ball/pendulum combination reaches its peak. For now, we will assume that kinetic energy is conserved. Set the initial kinetic energy of the ball/pendulum combination equal to its potential energy at peak equal height. Solve for the velocity of the ball/pendulum combination the instant after collision.
4. Use your answer from the previous question and the ‘conservation of momentum’ law to find the final momentum (post collision) of the ball and pendulum.
5. Create an equation for the initial momentum of the system (pre collision).
6. According to the ‘conservation of momentum’, initial and final momentum are equivalent if no external force is applied to the system. Set initial and final momentum equations equal to each other and solve for the velocity (i.e. Muzzle Velocity) of the steel ball the instant before it collides with the pendulum.

Part 2

Horizontal Distance Traveled:\_\_\_\_\_\_\_\_\_\_ Vertical Distance from the Ground: \_\_\_\_\_\_\_\_\_\_\_\_

1. Use the second kinematic equation to solve for the ‘time in air of the steel ball.
2. Using ‘distance = rate \* time’ solve for the initial velocity (i.e. Muzzle Velocity) of the steel ball.

Part 3

1. Compare the muzzle velocities obtained from Parts 1 and 2. What is the percent different?
2. What is the primary source of error for the discrepancy in velocity?
3. What is the name of this collision type? Write the definition for this collision type?
4. Given that your work in section 2 is correct, calculate the amount of energy lost as heat during the collision of the ball and pendulum.

Part 4

1. A 5 kg wood block pendulum collides with a 30 gram bullet and reaches a height of .19 meters. What is the initial velocity of the bullet?
2. A wood block pendulum with unknown mass collides with a 40 gram bullet and reaches a height of .1 meters. The bullet was initially traveling 400 m/s. What is the mass of the wood block pendulum (without the embedded bullet)?
3. A 15 kg wood block pendulum collides with an unknown bullet mass and reaches a height of .13 meters. The bullet was initially traveling 300 m/s. What is the mass of the bullet?
4. A 14 kg wood block pendulum collides with a bullet of mass 25 grams and reaches a height of .459 meters. The bullet and wood block pendulum combination were initially traveling 3 m/s. What is the velocity of the bullet before the collision?