**Ballistics: Application of Conversation Laws**

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Ballistics is the study of projectiles and how they behave when launched and during its flight []. The purpose of this experiment was to calculate the velocity of the projectile at launch by employing the conservation of momentum and the conservation of energy. To determine the velocity of the projectile we employed two methods, the first being a ballistics pendulum and the other being a spring firing system from a constant height. The first method we preformed 5 trials where we calculated the change in initial height with the final height after launch, the velocity we calculated came out to 6.23 m/s. The second method we preformed 5 trials where we calculated the distance traveled from a fixed vertical height, the velocity we calculated came out to 6.13 m/s. The percent difference of these two methods velocities came out to 1.69%.

**Section I: Background**

By performing this experiment, we got to find velocity by employing two different methods which allowed us to explore and understand what uncertainty in measurements could be and how it could affect experiments trying to find the same answer. The experiments’ objective was to take multiple measurements and apply them to the equations of the conservation of energy and momentum, in order to find the velocity of the ball at launch.

**Section II: Theory and Procedure**

The experiment that was preformed made use of spring-loaded fire mechanism that was fired by use of a trigger where the projectile (in this case a solid metal ball) was attached to a firing rod. The entire mechanism was attached to a solid base, which was attached to the surface of the table. The base also had a pendulum set where the ball would get caught in it and would travel up a rigid surface and get caught at the apex of the pendulum motion. The experiment was only concerned with the velocity of the ball so the spring is not of concern. In order to make use of the measurements we acquire in the first method (ballistics pendulum) we must make use of the following equation.

(1) []

This equation is derived from the equations of conservation of momentum, which states that momentum (p) is equal to product of mass (m) and velocity (v).

(2) []

For this method we must break up the mass variable into m (for the mass of the ball) and M (for the mass of the pendulum) since the pendulum is an active part of the experiment. To perform this first method of attaining the velocity of the ball, we must measure the initial resting height of the pendulum for the platform, and then fire the ball into the ballistics pendulum for five trials. Once fired we must measure the new height that the pendulum stops at on the arresting platform. Once we have five final height measurements, subtract each by the initial to get the change in height, and then apply it to equation 1.

To find the velocity of the ball using the second method, we use the following equation.

(3) []

To obtain the velocity by this method, we need to know some constants such as the vertical height (y) of the ball will fall which will be measured from the floor to the platform it is being launched from, and the value we will be measuring will be the horizontal distance the ball will travel which is (x). Fire the ball, and measure the distance traveled for five trials. Once five trials have been reached apply equation 3 to each horizontal distance and the average the five velocities. Once an average velocity has been found by each method, find the percent difference with the percent difference equation.

https://www.merriam-webster.com/dictionary/ballistics