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**Physics 201: Introductory Physics 1**

**Lab 4: Projectile Motion**

**Due Date: 9/28/2021**

**Date Performed: 9/14/2021**

**Objective**

The purpose of this labs to determine how the angle of the cannon effects the distance that the ball travels and how to calculate the initial velocity of the ball shot from the cannon. Also using a graph to determine what angles have the same distance.

**Introduction**

Projectile motion can be described as the motion of object projected in the air. We used this idea of projectile motion in the case of a cannon firing a metal ball though the air. In order to calculate the motion of a projectile we must have assumed values and split parts into x and y. Where the x is the horizontal components of motion and y is the vertical components of motion. Assumed values for the x is that a = 0 m/s^2 meaning throughout the motion the velocity never changes. The y direction the assumed acceleration is a = -9.8 m/s^2 this number is the acceleration due to gravity. The correlation between the x and y parts of motion is the time because the motion both must end at the same time. Using these assumed values for x and y motion we can find the initial velocity of the cannon. With this velocity we can see how the distance changes due to the angle of the cannon and plot it a graph to see the true relation between the angle and the distance.

**Materials**   
 A meter stick was used to measure how far the ball went for being fired from the cannon and to measure how high the cannon was. Paper was to see where the indent was caused by the ball. A cannon was used to launch a metal ball and black rod was used to cock the cannon. And a metal dish was used to and placed on the paper where we thought the ball would land.

**Methods**

For part one to calculate the initial velocity of the cannon we measured the height to the bottom of the ball. We put the cannon to the edge of the table so we could measure from the ground to the bottom of ball. Then we laid down metersticks along the paper and fired the cannon 10 times and averaged the distance from the cannon to find the range of the ball. To find the time the ball was in the air for we used Eq.1.

t = (1)

To find the initial velocity of metal ball we used Eq.2 where range is the average horizontal distance and time is what calculated with the last equation.

v₀ = Range / t (2)

For part two of the lab, we had to calculate we the ball would land at a certain angle. We first to find how long the ball would be in the air since it would be different than part one because of the new angle. But the initial velocity would be the same since it is coming out of the same cannon. To find the new time we used Eq.3.

t = = (3)

The new term is not zero any longer because the angle is not zero and sin (0) = 0 this is the new added term. With this new time, we calculated the new distance that the metal ball will go with Eq.4.

Range = (V₀cosΘ₀)t (4)

With the calculated range we placed a metal dish to our projected value and loaded up the cannon to see the actual value of the range. Then we calculated the percent error between the actual distance and the distance we calculated. For the last part we shot the cannon at different angles and wrote down the distances that they landed at. On excel we plotted a scatter plot graph to see the correlation between the angle and the distance.