1 Introduction

In this experiment, you will be developing a mathematical model that allows you to make quantitative predictions about projectile motion. You will then make measurements on an object that is undergoing projectile motion, and will analyze your measurements to see if they agree with your model.

2 A Mathematical Model of Projectile Motion

We consider an object that is launched through the air at some initial velocity ~v0 with magnitude v0 that makes an angle 0 with the horizontal. We can use our standard approach to find the horizontal and vertical components of the initial velocity. We have

v0x = v0cos0

v0y = v0sin0

We now need to develop a mathematical representation of the motion of the projectile as a function of time. You should have already discussed this in lecture, so take a few minutes to discuss this with your lab partner. Use the space below to write the details of the mathematical model used to describe projectile motion. Do not proceed until you have discussed this with your lab instructor.

**Xf= (V2 sin2 (theta))/g**

3 Experimental Apparatus

You have some apparatus provided to you that will enable you to make some measurements relating to projectile motion. Take some time and work with your lab partner to understand how the apparatus works, and what quantities you can measure with it. Write a description of how the apparatus works in the space below. Be as detailed as possible, and remember you are being asked to describe how the apparatus works, NOT what it does.

**Using an air pump to create potential force to launch a projectile from a single chamber across the room that has an adjustable angle, and it fires when pressing to buttons at the same time.**

List all of the quantities that you can measure with the apparatus in the space below.

**Theta, initial velocity, acceleration in y direction, time in air.**

4 Experiment Design

You now need to design an experiment that will allow you to compare the quantities you measure to a mathematical model. This may require some thought, and also might need to be revised after you begin making measurements. To begin, provide a description of how the apparatus will be set up to do your experiment. Include a drawing of how ALL of the different pieces of equipment will be arranged.

Canon angled at (theta) is launched at the pointed projectile stop canon connected to computer to collect data.

Now outline the procedure you will use to make measurements. This should include a step by step outline of what you will do, a list of the quantities you will measure, and what procedure you will use to estimate any uncertainty in your measured values. Write your procedure in the space below.

**Getting the initial velocity at a giving psi, we will give theta a specific number to put into the equation to test the launch distance to see weather our equation was right or wrong.**

Finally, describe how you will compare the values you measure to the mathematical model that describes projectile motion. Write your description in the space below. Do not proceed until you have consulted with your lab instructor.

**Using the computer to get the initial velocity we plug that velocity in our equation to come up with a theoretical distance where the ball should land and compare that to where the computer says the distances.**

5 Data Collection

Now, collect data using the procedure you outlined above. Record your data in the space below. If your data is in a computer generated table, you may print it and attach it to this report (please indicate that you have done this.)

Xf= (V2 sin2 (theta))/g

50 psi= 3.951 m/s

At 50 psi 15degrees theta the ball theoretically goes .796 m

1. (.79 m) 2. (.77 m) 3. (.83 m) 4. (.92 m) 5. (.82 m) 6. (.86 m) 7 (.8m)

8 (.79m) 9 (.785 m) 10 (.823m)

At 50 psi 10 degrees theta .544m

1. .7m, .7m, .69m, .695m, .675m, .67m, .66m, .74m, .7m, .695m

At 50 psi at 5 degrees theta .276m

1 .6m, .545m, .54m, 535m, .535m, .53m, .525m, .505m, .52m .515m

Now, use your measurements, and the procedure you outlined above, to see if your measurements agree with your mathematical model. Write your work in the space below.

6 Conclusions

In the space below, discuss what you learned from your experiment. Did your data agree with the mathematical model? If you answer yes, provide evidence to support this conclusion. If you answer no, give reasons why you think your measurements did not agree with the model. Your evidence should include the results of measurements and data analysis along with an analysis of your mathematical model. How did uncertainty in your measurements influence your conclusions? Be as explicit as possible.