Projectile Motion Lab 1

Aarya Batchu, Samuel Peterson, Shawn Tan

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Physics 1

1 Introduction

In this lab, we launched a projectile to test our equations for projectile motion. We wanted to make sure our experimental and theoretical values for distance traveled by the projectile and the initial velocity of the projectile matched.

1.1 Materials

- Metal ball
- Track
- BeeSpi V Advanced Self-Contained Photogate
- Table
- Meter stick
- Carbon paper
- Paper
- Pencil

2 Procedure

2.1 Setup

We put a track leading off the edge of the table with the BeeSpi velocity detector at the end to detect the speed of the ball just as it leaves the track. On the floor, we put a meter stick to detect how far the ball traveled. We put carbon paper on top of normal paper and taped it to the ground near the stick around the 0.5 meter mark.

2.2 Equations

The derivation of the equations is trivial and will be left as an exercise to the reader. They are

$$\Delta x = V_x \sqrt{\frac{2h}{g}}$$

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$$\text{Percent error} = 100x \frac{|\text{experimental} - \text{theoretical}|}{\text{theoretical}}$$

where V_x is the velocity measured by the BeeSpi, the constant h is the vertical distance between the floor and the table and is $0.91m$, and the constant acceleration g is $9.8m/s^2$ due to gravity.

2.3 Iteration

Each iteration, we put the ball on the ramp, pushed it, and tried to push it with the right velocity to land it on the carbon paper. It took too many tries, but eventually we got 5 successful trials with correctly measure initial velocity and distance.

3 Results

As described above, we measured the speed as the ball left the table and the distance it traveled. Using the first equation from 2.2, we found the predicted Δx in m using the measured speed and our constants for h and g. Then, we found the predicted speed in m/s using the second equation. After, we found the % Error for both speed and distance.

3.1 Data

Predicted Speed (m/s)	Measured Speed (m/s)	% Error
0.88	0.82	7.0
1.04	1.11	6.3
1.04	1.07	2.5
1.53	1.59	3.7
1.58	1.62	2.6

Table 1: Speed Measurements.

Predicted Δx (m)	Measured Δx (m)	% Error
0.35	0.38	7.5
0.48	0.45	5.9
0.46	0.45	2.4
0.69	0.66	3.7
0.70	0.68	2.6

Table 2: Δx Measurements.

3.2 Conclusions

Our % Error is below 10%, meaning our predicted values and equations are most likely correct. This proves our initial hypothesis that our equations for projectile motion are indeed correct.

The reason our % Error is not 0% could be due to a number of factors. First, the BeeSpi device we used to measure V_x could be wrong. Also, our measurements for h, g and Δx could have been incorrectly measured or rounded too much.

In conclusion, we are glad math works.