# Purpose

The purpose of this lab is to demonstrate the conservation of energy in a marble shot vertically from a marble launcher.

# Hypothesis

If a marble is launched from a marble launcher, then the kinetic energy at the barrel of the launcher would be equal to the potential energy at the max height.

# Methodology

To test our hypothesis, we set up a marble launcher and a measuring stick to measure the maximum height reached by the marble. We attached a photo gate timer to the barrel of the launcher to allow us to measure the time that the marble is blocking the gate. This would allow us to find the velocity of the marble for our analysis. For four trials, we launched a marble and recorded both the photo gate time and the maximum height. We used four trials so that we could take an average and use more precise values for our calculations.

# Data

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trial | Time (s) | VI­ (m/s) | VAvg (m/s) | Height (m) | PE | W | KE | KE - W |
| 1 | 0.0025 | 5.6 | 2.8 | 0.75 | 0.0406 | 0.000339 | 0.0866 | 0.0801 |
| 2 | 0.0025 | 5.6 | 2.8 | 0.7 | 0.0379 | 0.000339 | 0.0866 | 0.0801 |
| 3 | 0.0022 | 6.4 | 3.2 | 0.77 | 0.0417 | 0.000442 | 0.1130 | 0.1127 |
| 4 | 0.0026 | 5.4 | 2.7 | 0.67 | 0.0362 | 0.000315 | 0.0805 | 0.0774 |

# Constants & Equations

Marble Mass: 5.52 g = 0.00552 Kg

Marble Diameter (L in equations): 1.4 cm = 0.014 m

Marble Area: 0.00015 m2

Marble Drag Coefficient (C in equations) = 0.47

Air Density (p in equations) = 1.225 Kg/m3

Vf­ = 0 m/s

Vi = L/t

Vavg = (Vi + Vt) / 2

A = πr2

W = ½pvavg2CA

PE = mgh

KE = ½mv2

∑Ei = ∑Ef

KE – W = PE

# Analysis

Our data does not support our hypothesis. This is because our kinetic energy minus work due to friction is much higher than our potential energy, in most cases by a factor of two. This is likely because there were external factors that were unaccounted for in our math. There may have also been some issues in measuring our height, as we eyeballed the height along a meterstick. This could have been fixed by videotaping the trials and pausing the video at the true peak height. Another issue could have been caused by how we measured our marble’s speed. Because we used the diameter of the marble as the length, if the photo gate timer was even slightly offset, we would have gotten drastically different times. Another possibility is that the glass marble diffused some of the light in the photogate timer, although that is a much less likely possibility.