Projectile Motion Lab
Purpose: Analyze projectile motion using video analysis

Background: Projectile motion is defined as motion without wings, propulsion, friction under the influence of gravity (formula: Range $=\mathrm{Vo}^{\wedge} 2 / \mathrm{g} \sin (2 \theta)$

Materials:
-Laptop computer with camera
-Logger Pro
-Meter stick
-Ball
-Cone
-Hat

Procedure:

1) Set up the meter stick (use the cone to stabilize it.)
2) Put a hat on top of the meter stick, so you can see the meter stick
3) Set up laptop facing the throw
4) Throw the ball while starting the video capture
5) Retrieve the ball
6) On logger pro, put dots on the graph
7) Analyze the graph, $x$ velocity and $y$ velocity gravity from $s=1 / 2 a t^{\wedge} 2$

|  | VideoAnalysis |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Time <br> (s) | $\begin{gathered} \mathrm{X} \\ (\mathrm{~m}) \end{gathered}$ | $\begin{gathered} \mathrm{Y} \\ (\mathrm{~m}) \end{gathered}$ | $\begin{gathered} \mathrm{Vx} \\ (\mathrm{~m} / \mathrm{s}) \end{gathered}$ | $\begin{gathered} \mathrm{Vy} \\ (\mathrm{~m} / \mathrm{s}) \end{gathered}$ |  |
| 1 | 3.540 | 0.8246 | 2.249 | 0.628 | 1.483 |  |
| 2 | 3.607 | 0.8405 | 2.313 | 1.232 | 2.232 |  |
| 3 | 3.640 | 0.9043 | 2.426 | 2.469 | 3.569 |  |
| 4 | 3.672 | 1.016 | 2.571 | 3.231 | 4.147 |  |
| 5 | 3.738 | 1.239 | 2.878 | 3.503 | 3.933 |  |
| 6 | 3.805 | 1.495 | 3.087 | 3.518 | 3.646 |  |
| 7 | 3.838 | 1.590 | 3.233 | 3.477 | 3.431 |  |
| 8 | 3.870 | 1.718 | 3.329 | 3.487 | 2.668 |  |
| 9 | 3.937 | 1.941 | 3.491 | 3.377 | 2.164 |  |
| 10 | 3.970 | 2.053 | 3.539 | 3.340 | 1.761 |  |
| 11 | 4.035 | 2.261 | 3.668 | 3.457 | 1.308 |  |
| 12 | 4.068 | 2.388 | 3.684 | 3.660 | 0.571 |  |
| 13 | 4.135 | 2.643 | 3.700 | 3.565 | 0.255 |  |
| 14 | 4.167 | 2.739 | 3.716 | 3.439 | -0.172 |  |
| ] 15 | 4.233 | 2.978 | 3.684 | 3.358 | -0.568 |  |
| 16 | 4.267 | 3.074 | 3.652 | 3.314 | -0.851 |  |
| 17 | 4.332 | 3.298 | 3.604 | 3.402 | -1.241 |  |
| 18 | 4.365 | 3.409 | 3.539 | 3.522 | -1.944 |  |
| 19 | 4.398 | 3.537 | 3.475 | 3.500 | -2.628 |  |
| 20 | 4.465 | 3.760 | 3.281 | 3.465 | -3.146 |  |
| 21 | 4.530 | 4.000 | 3.055 | 3.351 | -3.579 |  |
| 22 | 4.563 | 4.079 | 2.910 | 3.371 | -3.807 |  |
| 23 | 4.597 | 4.223 | 2.813 | 3.451 | -4.460 |  |
| 24 | 4.628 | 4.319 | 2.620 | 3.183 | -4.965 |  |
| 25 | 4.695 | 4.526 | 2.329 | 3.184 | -5.359 |  |
| 26 | 4.762 | 4.734 | 1.926 | 3.286 | -6.030 |  |
| 27 | 4.795 | 4.861 | 1.701 | 3.341 | -6.409 |  |
| 28 | 4.827 | 4.957 | 1.507 | 3.170 | -6.364 |  |
| 29 | 4.893 | 5.180 | 1.007 | 2.889 | -4.854 |  |
| 30 | 4.958 | 5.356 | 0.7168 | 2.344 | -1.323 |  |
| 31 | 4.992 | 5.404 | 0.9265 | 1.666 | 3.284 | * |
| 7 | $\rightleftarrows$ |  |  |  |  |  |

Graph:


Observations: There was no wind when we were throwing the all so it traveled gracefully. We were standing at the top of a hill so when we threw the ball it often rolled down the hill afterward and we had to go get it. We threw the ball high into the air and it then came backdown in the shape of a parabola. Our ball bounced quite a few times before rolling because it was thrown at an angle above 45 degrees.

Analysis: Our main problem was that we could not find out graph until the last minute because there is not Logger Pro in the dorms. We also had trouble seeing wether or not we were actually recording the ball being thrown because it was bright outside so we couldn't see the computer screen. We had to throw the ball a couple times before actually capturing it on the computer. It was hard for us to see your meter stick because it was almost the same color as the grass, so we put a hat on top of the meter stick.

Conclusion: Our experiment was successful. We were able to analyze the projectile motion using video analysis. The ball was accelerating the whole time it was in the air. The velocity of the ball was decreasing as it went up, zero when it reached it's peak because it was not moving for a millisecond and then the velocity decreased as the ball came towards to ground.

