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Ball Toss Lab Write-up



Objective: Determine g based on ball graphs.

Procedure:

1. Attach motion detector to laptop and start tracking data
2. Line up the ball above and in center to the motion detector then toss the ball directly upwards and catch the ball.
3. Measure the position, velocity and acceleration of a ball being tossed above the motion detector.
4. Conduct many trials to improve accuracy.

Data:

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| --- | --- |
| Chart, line chart  Description automatically generated | Chart, line chart  Description automatically generated |
| Chart, line chart  Description automatically generated | Chart, line chart  Description automatically generated |
| Chart, line chart  Description automatically generated | Chart, line chart  Description automatically generated |

Analysis:

1. -4.688t2 + 7.07t – 1.934 (g = -9.376 m/s2)

Peak: 0.7321m (0.75s)

-9.198t (m/s) (g = -9.198 m/s2)

Mean: -9.094 (m/s2)

1. -4.744t2 + 7.082t – 2.034 (g = -9.488 m/s2)

Peak: 0.6092m (0.75s)

-9.576t (m/s) (g = -9.576 m/s2)

Mean: -9.575 (m/s2)

1. -4.675t2 + 6.106t – 1.337 (g = -9.350 m/s2)

Peak: 0.6565m (0.65s)

-9.43t (m/s) (g = -9.430 m/s2)

Mean: -9.462 (m/s2)

1. -4.790t2 + 6.617t – 1.763 (g = -9.580 m/s2)

Peak: 0.5214m (0.7s)

-9.585t (m/s) (g = -9.585 m/s2)

Mean: -9.603 (m/s2)

1. -4.692t2 + 5.770t – 1.168 (g = -9.384 m/s2)

Peak: 0.6047m (0.6250s)

-9.313t (m/s) (g = -9.313 m/s2)

Mean: -9.431 (m/s2)

1. -4.786t2 + 8.061t – 2.861 (g = -9.572 m/s2)

Peak: 0.5335m (0.85s)

-9.614t (m/s) (g = -9.614 m/s2)

Mean: -9.644 (m/s2)

Conclusion:

The average (mean) acceleration due to gravity was -9.460 m/s2, with all data being within the range of -9.094 m/s2 to -9.644 m/s2.

Sources of Error:

* Imperfection of vertical throw affected position, velocity, and acceleration graphs as the ball was spherical rather than a flat surface, so left and right shifts appear to the motion sensor as quicker or slower movement.
* The acceleration due to gravity calculated in the lab is in reality based upon the average net force, therefore it does not account for air resistance. Different objects have different surface areas and shapes changing the acceleration they experience in free-fall.
* Start and end times used to calculate best fit lines and formulas in analysis were not consistent across all graphs, therefore resulting in varying acceleration within the same data set.