Acceleration Due to Gravity

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Objective of the experiment:

The purpose of this laboratory activity is to measure the acceleration of a falling object assuming that the only force acting on the object is the gravitational force.

Theory:

One equation describing the motion of a body starting from rest and undergoing constant acceleration can be expressed as: , where **d** is the distance the object has traveled from its starting point, **a** is the acceleration of the object, and **t** is the time elapsed since the motion began. Therefore, the acceleration is equal to the distance doubled, divided by the time squared, or: . (t^2 = time squared, I could not figure out how to do the square sign)

Procedure:

First, we got the base and support rod set up on the table and we put the free fall adapter onto the rod. Then, we used two meter sticks to measure the height from the base of the ball to the top of the landing pad on the ground. After that, we got the free fall adapter hooked up to *Science Workshop Interface* on the computer to time how long it takes the ball to release. To release the ball there was a little tightening screw on the free fall adapter that we unscrewed to release the ball at free fall speed and did so five (5) times at five different heights of; 1.5m, 1.25m, 1.0m, .75m, and .5m. We recorded the results and got the average of all the time trials for our results.

Data:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Trial | 1 | 2 | 3 | 4 | 5 |
| Distance (m) | 1.5m | 1.25m | 1.0m | .75m | .5m |
| Time (s) | .3917s | .5551s | .5049s | .4571s | .3288s |
| 2d (m) | 3.0m | 2.5m | 2.0m | 1.5m | 1.0m |
| Time2 (t^2) | .3081s2 | .2549s2 | .2089s2 | .1534s2 | .1081s2 |
| G=2d/t^2 | 9.7371 | 9.8087 | 9.5739 | 9.7784 | 9.2507 |

Calculations:  
G=2d/t^2  
% error = (|Accepted – Measured|/Accepted) \* 100

Results:

The results of our data show that we were 1.7% off of the accepted value of 9.8 m/s^2 with an average of 9.63 m/s^2.

Errors:

Some of the possible errors that we came up with were that using old wooden meter sticks could be off by a mm or two and throw our results slightly.   
Another error possibility could be the way that we each put the ball into the free fall adaptor by how tight we tightened the screw or by how long it took us to release the ball.  
The last error possibility we came up with was how the ball landed on the landing pad and we were not sure if that would or would not mess with results of the test.

Conclusion:

I learned that not everything falls at free fall speed and that it is very difficult to get the same exact results for every trial that we do. Even though the same ball was getting dropped every time the answers came up different every time.   
I do think that the experiment accomplished the objective of the lab.

References:

None, everything was given except I used the last lab to get the equation for percent error.