Physics Lab: Freely Falling Objects

Procedure:

<table>
<tr><td rowspan="5">1) Drop a tennis ball from a height of 1 meter and measure the time it takes to hit the ground.
2) Repeat three more times, for four trials total.
3) Repeat steps 1 and 2 from 1.5 meters.
4) Repeat from 2 meters.
5) Repeat from 2.5 meters.</td><th>1.0 m</th><th>1.5 m</th><th>2.0 m</th><th>2.5 m</th></tr>
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<tr><td>Average times:</td><td></td><td></td><td></td><td></td></tr>
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Analysis:

1) For each of the four heights, calculate the average time of the four trials.

2) Construct a plot of the height (y-axis) vs. average falling time (x-axis).

3) Draw horizontal error bars on each of your data points. The total size of each error bar should be twice the reaction time of the person who did the timing (both plus and minus the reaction time, as discussed in class).

4) As best you can, draw a parabola through your data, starting at the origin.

5) Calculate the square of each of the four average times.

6) Make a plot of height (vertical axis), versus average time squared (horizontal axis).

7) Draw a straight line that you think best fits your data, starting at the origin.

8) Choose two points ON THE STRAIGHT LINE for which the precise coordinates are easy to determine. (You CANNOT use data points unless they are ON THE STRAIGHT LINE!) . Illustrate these points on your graph by labeling the coordinates.

9) Calculate the slope of your straight line, based on the chosen coordinates.

10) Multiply the slope by 2; this is your value of the acceleration due to gravity, g.

11) Calculate the percent difference between your value of g and the known value.

12) Draw a dotted line (on the second graph) showing what your graph would look like if you had measured g exactly equal to the known value.

13) Are your results consistent with air resistance affecting the acceleration? Explain.